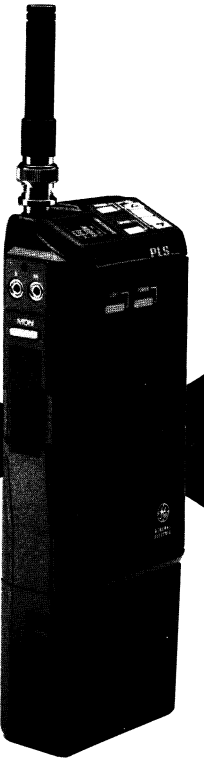
MOBILE RADIO

# PLS™

## MAINTENANCE MANUAL LBI-31742

## SERVICE SECTION LBI-31790



450 - 470 MHz
PERSONAL
TWO-WAY FM FADIO

GENERAL ELECTRIC

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## ILLUSTRATIONS

## SPECIFICATIONS

### SYSTEM

| | |
|---|---|
| FCC Identification Number | AXA9WN PLSUO4 |
| Frequency Range | 450 MHz - 470 MHz |
| Frequency Stability | 5 PPM |
| Battery Drain (at 7.5 VDC) | |
| Standby | 62 Milliamperes |
| Receive (Rated Audio) | 182 Milliamperes |
| Transmit | 1.7 Amperes |
| Dimensions (H X W X D) | 188mm X 68mm X 42mm (With 800 mAh battery pack) |
| Weight | 22 oz (With 800 mAh battery pack) |
| Operable Temperature Range | -30° C to +60°C |

### TRANSMIT

| | |
|---|---|
| RF Power Output | |
| High Power | 4 Watts |
| Low Power | 1 Watt |
| Spurious Emissions | -52 dB |
| Maximum Deviation | 5 kHz |
| FM Hum & Noise (EIA) | -40 dB |
| Audio Distortion (60% Modulation) | 7% |
| Frequency Stability (PPM) (-30°C to + 60°C) | +5 PPM |
| RF Load Impedance | 50 ohms |
| Microphone Sensitivity (EIA 60% Modulation) | Less Than 90 dB SPL |
| Maximum Attack Time (PTT Pushed) | 30 milliseconds |
| Audio Frequency Response | Within +1 and -3 dB of a 6 dB/octave pre-emphasis from 300 Hz to 3000 Hz. |

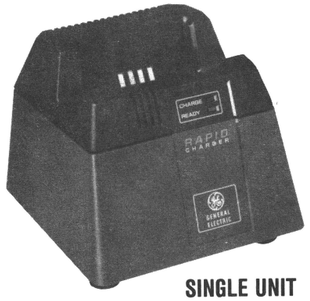
**RECEIVER**

| | |
|---|---|
| Sensitivity (12 dB SINAD) | 0.4 Microvolts |
| Spurious Emissions | -57 dBm |
| Spurious Response Rejection (EIA) | -60 dB (Minimum) |
| Distortion (EIA 0.35W) | 10% |
| Audio Frequency Response | Within +1 and -8 dB/octave de-emphasis from 300 Hz to 3000 Hz with the following constraints; 0 to 210 Hz -30 dB Maximum. Referenced 1000 Hz. |

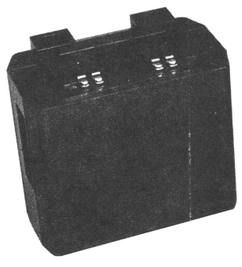
## COMBINATION NOMENCLATURE

| Digits 1 & 2 | Digit 3 | Digit 4 | Digit 5 | Digit 6 |
|---|---|---|---|---|
| Product Code | Radio Type | Frequency Band | Frequency Split | RF Power Output |
| PL | S<br>Synthesized | U<br>450 - 470 MHz | O<br>None | 4<br>4 Watts |

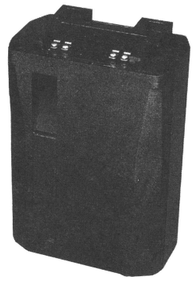
### FIVE-UNIT MULTI-BATTERY CHARGER
1 HOUR UNIT H2A2J1A
16 HOUR UNIT H2A2L2A



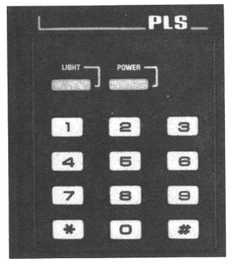

### SINGLE UNIT DESK CHARGER
1 HOUR UNIT H2A1J1A
16 HOUR UNIT H2A1J2A



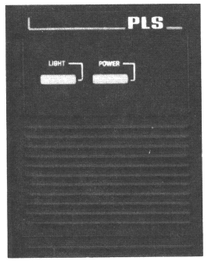
### 800 mAh BATTERY
OPTION PLPA10
(19A704850P1)



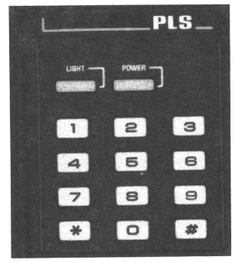
### 1200 mAh BATTERY
OPTION PLPA11
(19A704860P1)




### DTMF PANEL
OPTION PLDT01
(19A704723P11)




### T99 PANEL
OPTION PLSS01
(19A704723P12)




### DTMF & T99 PANEL
OPTION PLMK01
(19A704723P13)

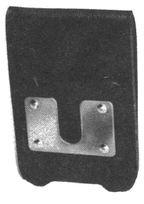
### TWO INCH ANTENNA (450-470 MHz)
OPTION PLNC12
(19B800763P13)

### SPEAKER/MICROPHONE WITH VELCRO MOUTH
OPTION PLAE11
(19D43748364 MIKE)
(19A129791G1 BADGE)

### SPEAKER/MICROPHONE WITH CLIP MOUNT
OPTION PLAE12
(19D437483G2)

### EAR SPEAKER
OPTION PLAC19
(403357066)

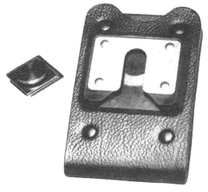
### SWIVEL MOUNT/CASE BELT LOOP



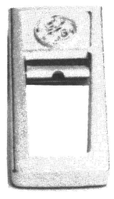
### CASE & BELT LOOP
RADIO W/800 mAh BATTERY, OPTION PLHC11
(19D901765P2)
RADIO W/1200 mAh BATTERY, OPTION PLHC12
(19D901765P4)

### CASE/SWIVEL MOUNT/BELT LOOP
RADIO W/800 mAh BATTERY, OPTION PLHC13
(19D901765P1)
(19B226627G1 LOOP)
RADIO W/1200 mAh BATTERY, OPTION PLHC14
(19D901765P3)
(19B226627G1 LOOP)

### SWIVEL MOUNT PLATE & BELT LOOP



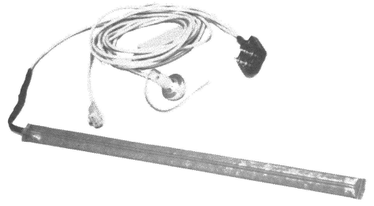
### BELT CLIP



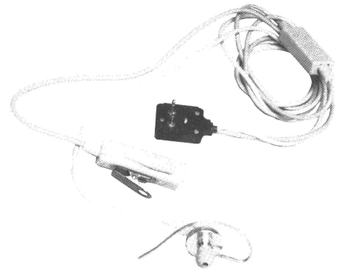
### BELT CLIP OPTION PLHC15
(19B233241G1)
(19A144704G1 MOD KIT)

### SWIVEL MOUNT PLATE & BELT LOOP
OPTION PLHC16
(19B226627G1 LOOP)
(19B233243 SWIVEL)
(19A144704G1 MOD KIT)

### SK-1 SECURITY PACKAGE
OPTION 1226



### SK-2 SECURITY PACKAGE
OPTION 1227



### SK-3 SECURITY PACKAGE
OPTION 1228

### LAPEL SPEAKER
OPTION PLAD10
(19A116502P1 SPEAKER)
(19A116502P2 CABLE)

## DESCRIPTION

General Electric's PLS Personal Radio is a high quality, high performance, two-way, FM, communications unit consisting of a transmit/receiver circuit with a frequency synthesizer controlled by a microprocessor. The PLS Personal Radio is ideal for use in public services by providing the following features:

- **16 Channel Capability:** There are two modes of operation and eight channels are selectable for each mode using the "MODE" button. The channels can be selected with or without tone. The transmit and receive frequencies are programmed separately and can be the same. The channel button is used to increment to the next programmed channel. The monitor push button allows the user to monitor the channel before transmitting.

- **Programmable Multi Tone Channel Guard (CTCSS) Encode/Decode:** Channel Guard tone frequencies within the range of 67 Hz to 210.7 Hz, including all of the standard EIA frequencies, may be programmed. Different encode/decode, encode only and with/without Channel Guard frequencies are also programmable into the radio.

  The same channel is used with and without Channel Guard by programming two different radio channels with the same frequency information but only one with Channel Guard capability.

- **Programmable Carrier Controlled Timer:** Personality information includes an optional period of transit time in thirty second increments after which the unit will automatically unkey and provide an alerting tone. This feature is re-initiated on every PTT and the alert tone is removed upon release of the PTT.

- **Squelch Tail Elimination:** Squelch and audio circuits are designed so that annoying squelch "pops" which may occur at the end of received messages are minimized. This system of squelch tail elimination is compatible with an existing GE system.

- **Programmable Squelch:** The noise squelch opening threshold can be programmed for each channel.

- **Liquid Crystal Display:** This display has one digit and five status displays and is used to exhibit the condition of the radio. It shows: Mode 1 or 2, Channel Number and Power HI or LO. The transmit indication is the flashing of the HI or LO power indicator.

- **Simple Remote Control Capability:** By connection through the jack connectors a simple speaker microphone can be operated which can also control PTT.

- **Push Button Controls Only:** All control functions on the radio, with the exception of the power ON/OFF switch, are operated through push button controls on the top and sides of the radio. The power ON/OFF switch is part of the battery pack (see Figures 1 & 2).

- **Programmable through jack connectors:** The entire personality of the radio is programmed into the radio through the jack connectors using the General Electric Universal Programmer TQ2310.

Physically a PLS radio consists of a plastic control housing, an aluminum back plate assembly, three printed circuit boards and a battery pack as follows:

a. A specially shielded printed wire board radio assembly (transmit/receive/synthesizer) is mounted on the aluminum back plate.

b. A Logic Control Board with the microprocessor. This board is located in the control housing.

c. A key pad providing switches and optional circuits is also mounted in the control housing.

d. A battery pack that fits the PLS main unit

Radio Assembly

Transmit:

The transmit circuit is made up of four major circuits as follows:

a. Wideband Exciter: Amplifies the signal from the frequency synthesizer approximately 21 dB.

b. Wideband Power Amplifier: Amplifies the output signal of the exciter (13 dB to 18 dB) to the desired output level for transmission.

c. Wideband Power Control module : Provides constant control of the transmit output level.

d. Output Low Pass Filter (LPF): Consists of a three stage LPF to eliminate higher harmonics.

The transmit circuit completely covers the band with no adjustments except for the RF power control voltage from the controller.

Receive Circuit:

The receive circuit, like the transmit circuit, consists of three major circuits as follows:

a. Front End Circuit: Consists of a single stage preamplifier with about 12 dB gain and the pre-BPF's and post-BPF's of the preamplifier.

b. First Mixer and IF Circuit: A special double balanced mixer to provide a 45 MHz first IF, which is passed through band pass filter (BPF) and an IF amplifier to get the desired first IF signal.

c. Second IF: (455 kHz) Consists of one IC and one BPF, containing the second mixer, second IF amplifier and FM detector. The second IF output provides the Logic section with audio output.

Frequency Synthesizer:

The frequency synthesizer is made up of two major modules as follows:

a. VCO Module: The UHF band frequency synthesizer has one VCO for transmitting and for receiving.

b. Phase Lock Loop: Consists of a frequency divider and low current drain CMOS IC for phase comparison.

Logic Circuit

The Logic Circuit consists of a LCD board and a control board with an audio IC as follows:

a. LCD Board: Includes Volume Up/Down switches , mode switch, channel switch and LED for LCD illumination.

b. Control Board: Carries a microprocessor, a RAM, audio circuit and I/O interconnections with the radio board and the display. This board commands all of the functions and operations of the PLS radio.

Power Supply

The PLS battery pack connects to the bottom of the PLS radio to supply 7.5 VDC. The battery pack is available in two types: an 800 mAh capacity and a 1200 mAh capacity. To charge these battery packs, chargers are available in two different types: a standard 16 hour charger and a rapid one hour charger.

## OPERATION

The PLS Personal Radio is delivered disassembled into three parts as follows:

1. PLS Radio (Main Unit)
2. Antenna
3. Battery Pack

Assemble these parts into one unit according to the following procedure and as shown in Figure 1 - PLS Operating Controls and Accessories.

1. Screw the antenna (2) in its receptacle. A clockwise turn will connect the antenna, while a counterclockwise turn will remove it.

2. Slide the battery pack along the bottom of the PLS radio from the arrow marked direction shown in Figure 1 until the battery pack locks into place.

Operating Procedure (Refer to Figures 1 and 2)

To Receive A Message:

1. Slide the Power switch 8 on the side of the battery pack up to turn on the radio. The display will indicate the current status of the radio, i.e., channel, mode or Hi/Lo power.

2. Select a desired volume level by pressing and holding the VOL ▲ or ▼arrow while listening to the beeps.

3. Select the desired operating channel by pressing the MODE switch to select the mode (1 or 2) and then press the CHAN switch to select the channel.

4. Your PLS radio is now ready to receive messages.

TYPE 99 TONE

**NOTE**

Only those channels programmed to decode Type 99 tones may be used to receive your personal messages. When receiving a message, you will first hear a tone and then your message.

1. Select the appropriate channel to receive the message.

2. After answering the message, momentarily press the **MON** push-button to reset the radio for the next call and to avoid hearing nuisance calls.

To Send A Message:

1. Turn the radio on and select the operating channel as instructed in To Receive A Message. The current status of the radio is displayed in the LCD window.

2. Select the transmit power level Hi or Lo.

3. Press the **MON** switch to determine if the channel is in use. **NEVER** interrupt another conversation.

4. While holding the radio so that the antenna is vertical, press the PTT switch and speak directly into the grill or across the face of the radio. If using the external microphone press the PTT switch on the microphone and speak into the microphone. Speak in a normal voice. Release the PTT switch as soon as you stop talking. Messages cannot be received while PTT switch is pressed.

DTMF Signaling:

Your radio may be equipped with a Dual Tone, Multi Frequency (DTMF) encoder key pad. The key pad has 12 keys. The keys are "0" through "9", an asterisk (*) and a pound key (#). These keys are used to gain access to a standard telephone system from a two-way radio DTMF Signaling System.

1. Select the DTMF channel.

2. Simultaneously press the PTT switch and the individual keys on the keypad. A tone is heard each time a key is pressed.

Controls and Indicators:

**NOTE**

A beep is sounded each time a switch is operated (except **MON** and **PTT**). For repeating switches (**CHAN**nel and **VOL**ume) a beep is heard each time the action occurs.

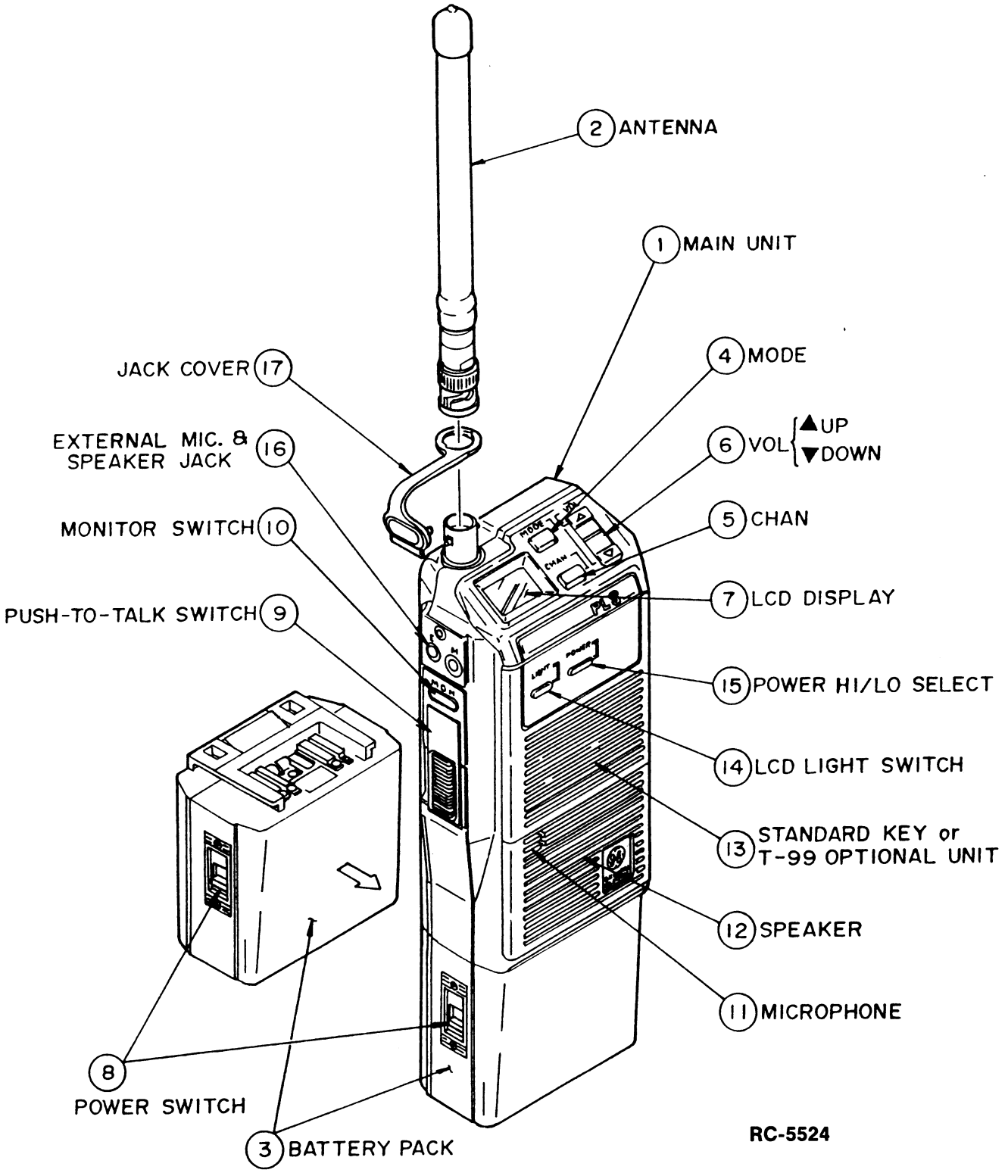



FIGURE 1 - STANDARD PLS OPERATING CONTROLS AND ACCESSORIES

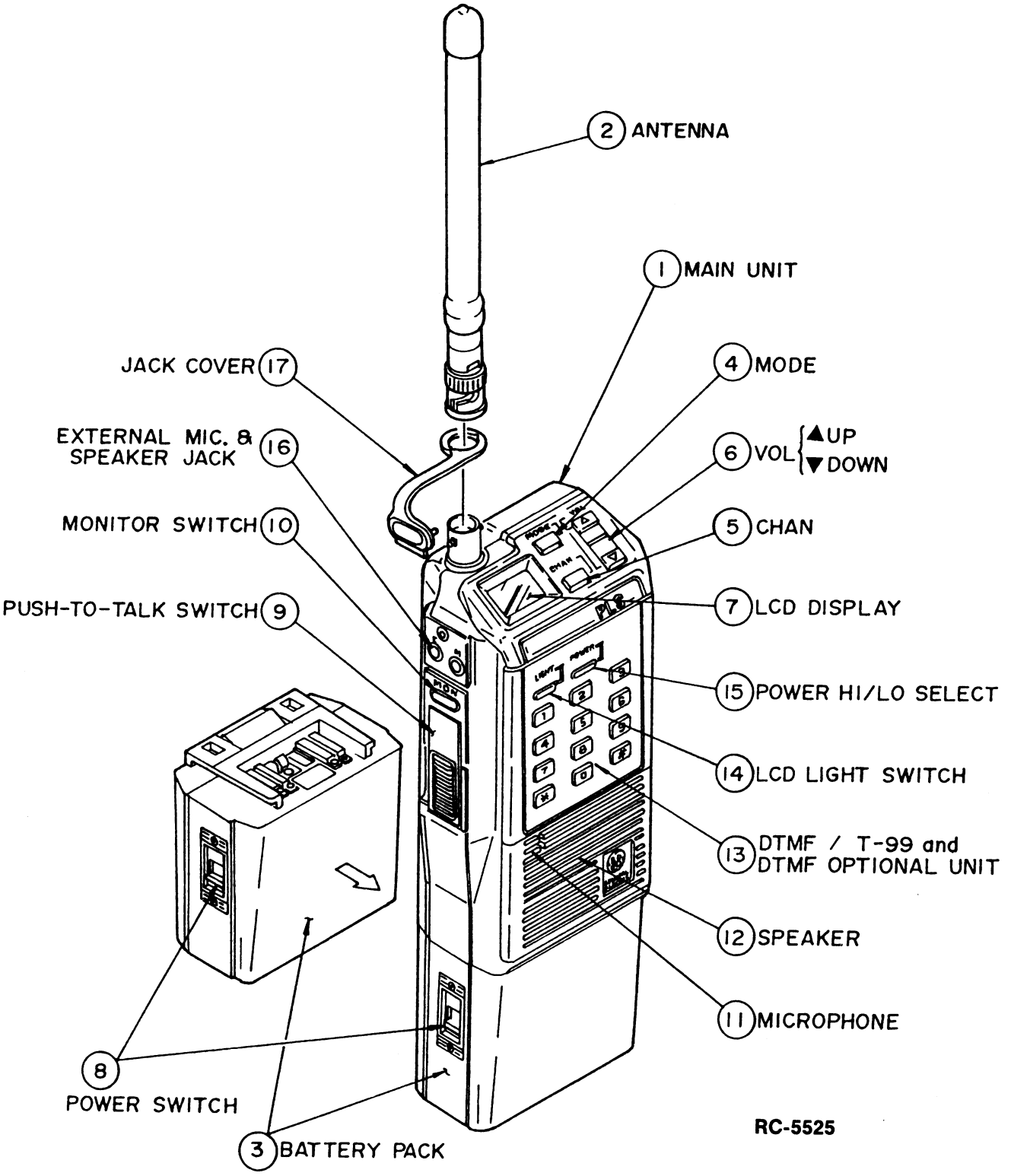



FIGURE 2 - PLS WITH OPTIONAL DTMF AND TYPE 99 OPERATING CONTROLS AN ACCESSORIES

Controls:

**WARNING** The on/off slide switch on the battery pack controls power from the battery to the radio. When turned on, an audible click of the switch will be heard and a light yellow square will show beneath the switch. The radio will assume its last operating state, i.e., channel and volume. Hi Power level is always selected. This status is displayed in the LCD window, indicating power is applied. BE SURE the power switch is fully on or fully off.

**VOL** Sets receive audio to the desired level while pressing the up or down (arrow) and listening to the beep. Pressing and holding the switch will continue to increment the volume in the direction indicated on the switch.

**MON** The receiver may be unsquelched by pressing and holding the **MON**itor switch located on the left side of the radio. This allows the user to monitor the channel.

**CHAN** Selects the transmit/receive operating channel. Channels may be selected one at a time or progressively by pressing and holding the **CHAN** switch. **NOTE:** The next higher channel is always selected (Channel 1 follows Channel 8).

**MODE** Selects mode 1 or 2. The current operating mode is displayed in the window (Each mode contains up to eight channels). Momentarily press the **MODE** switch to change modes.

**NOTE**

When changing modes, the channel and channel status are transferred to the new mode. If the channel is not programmed, the next higher programmed channel will automatically be selected.

**LIGHT** Controls the display backlight. Momentarily press the **LIGHT** switch to turn on. The backlight will automatically turn off when the preprogrammed time elapses. Pressing the **LIGHT** switch a second time will also turn the light off.

**POWER** Selects high or low transmit power. The selected power level, "**HI** or **LO**", is displayed in the LCD window.

**PTT** Keys the radio on the channel and mode displayed. Will not key on channels programmed for receive only, but will sound an alarm (successive beeps and pauses).

**E** External earphone jack.

**M** External microphone jack.

Indicators:

The LCD display indicates the channel, mode and power level selected. In addition, the power indicator serves as a transmit indicator.

**HI/LO** Indicates selected transmit power level for the channel displayed.

**TX** Transmit mode is indicated by a flashing HI/LO (depending on power level selected) in the display window when the PTT switch is operated.

**WARNING** An audio alert tone (beeps) is sounded as a warning to the user that a failure associated with the selected channel or radio has occurred. A failure of the frequency synthesizer to lock on frequency or receipt of incorrect channel data will cause the alarm to sound and inhibit the transmit mode for that channel. The user may select another channel or have the unit repaired.

**CARRIER CONTROL TIMER** This option unkeys the transmitter when the user exceeds the preprogrammed time for continuous transmission and produces a continuous beeping tone until the PTT switch is released. Releasing the PTT switch resets the timer.

## OPERATING TIPS

The following conditions tend to reduced the effective range of two-way radios and should be avoided whenever possible.

- Operating the radio in low areas or while under power lines or bridges
- Operating the radio inside of a vehicle or in a metal or steel frame building, unless using an outside antenna
- Obstructions such as mountains or buildings between the person transmitting the message and the person receiving the message
- In areas where transmission or reception is poor, some improvement may be obtained by insuring that the antenna is vertical. Moving a few meters in another direction or moving to a higher elevation may also improve communications.

## REPLACEMENT OF BATTERY PACKS

To Remove The Battery Pack From The Radio:

1. Turn the radio off by sliding the on/off switch to the "off" position (refer to Figure 3).
2. Press down on the battery release latch and slide the battery pack out toward the back of the radio.

To Reconnect the Battery Pack to the Radio:

1. Be sure the on/off slide switch on the battery pack is in the "off" position (refer to Figure 4).
2. Align the battery pack with the grooves in the back of the radio and slide the battery pack toward the front of the radio.

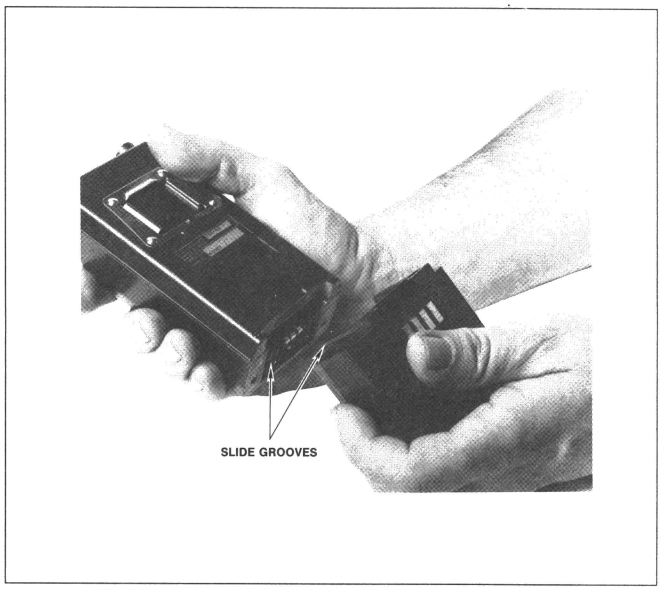



FIGURE 4 - INSTALLING THE BATTERY PACK

FIGURE 3 - REMOVING THE BATTERY PACK

## CHARGING BATTERY PACKS

The radio is equipped with a battery indicator which will be displayed in the LCD display when the battery pack voltage drops below 6 volts DC and requires charging. There are several chargers and charge rates available for charging the battery packs. For specific instructions refer to the applicable charger Operating Manual.

## SYSTEM ANALYSIS

General Electric PLS Personal radios are two-way, FM radios designed for public communications. The PLS radio consists of three printed wire boards as follows:

- Radio Board: carries the transmit, receive and frequency synthesizer circuits
- Control Board: supports logic control and audio processor circuits
- Flexible Printed Wire Board: carries LCD Displays and switch
- Key Board: switch with rubber contact

Interconnection of the control board with other boards and control circuits is made with flexible circuit boards and connectors. All control leads which are "barred", such as $\overline{PTT}$, means that the function indicated occurs when the lead is in a low voltage condition.

Circuit illustrations shown in the following text are simplified representatives of actual circuits. They are intended only to illustrate basic circuit functions.

## RADIO BOARD

Transmit Circuit

The PLS transmit circuit, as shown in Figure 5 - Radio Board Block Diagram, consists of the following circuits and integrated circuit modules:

- Amplifier (TX-Amp)
- Power Amplifier (PA)
- Antenna Switch (AS)
- Filter Network (FN)

Amplifier Module (TX-Amp):

RF from the synthesizer circuit is applied to the base input of an RF amplifier circuit (TX-Amp) consisting of two discrete transistors, Q204 and Q205. This amplifier circuit with a +2 dBm RF signal on the input produces an RF gain of 23 dBm on the output. This circuit is broadband and does not require tuning. The output is applied through attenuator circuit R-ATT (R223, R224 and R225) to the input of Power Amplifier Module A202 (PA).

Power Amplifier Module (PA):

Power Amplifier A202 is a three stage wide band RF amplifier module with an input and an output impedance of 50 ohms (refer to Figure 6). The first stage of the PA module has the DC power supplied by power control transistor Q206. The RF power output from the TX-Amp circuit is connected to Pin 1 of the PA module where it is applied to the input of the first power amplifier stage in the module. This power amplifier module amplifies the 21 dBm input from the TX-Amp circuit to a typical power output level of 5 watts at Pin 5. The output at Pin 5 connects through power control module A203 and TX-RX switching diode CR201 to a low pass filter network. The low pass filter network consists of capacitors C217, C221 through C227 and inductors L208 through L211. A minimum power level of 4 watts is on the output of the filter network.

Power Control Module (A203):

The RF power output of the radio is regulated by sensing variations in the RF power output of the transmit PA module to control the supply voltage going to the first stage of the PA module (refer to Figure 7). Supply voltage cannot be applied to the first stage of the PA module until the transmit circuit is keyed, applying 5.4 Volts to Pin 11 of the Power Control (PC) module A203. When the transmit circuit is keyed, the output of a reference amplifier, determined by the High/Low power control, is applied to the positive (+) input of a comparator circuit.

The output of the final PA is connected to Pin 1 of the PC module and to the 50 ohm coupled line. The detected voltage of the coupled output is applied to the negative (-) input of the comparator. The amplifier is enabled when the transmit circuit is keyed, until then, the output of the amplifier is low and transistor Q206 is held off. As the PA module begins to increase output power, the detected voltage causes the series regulator circuit to regulate the supply voltage to maintain constant RF output power.

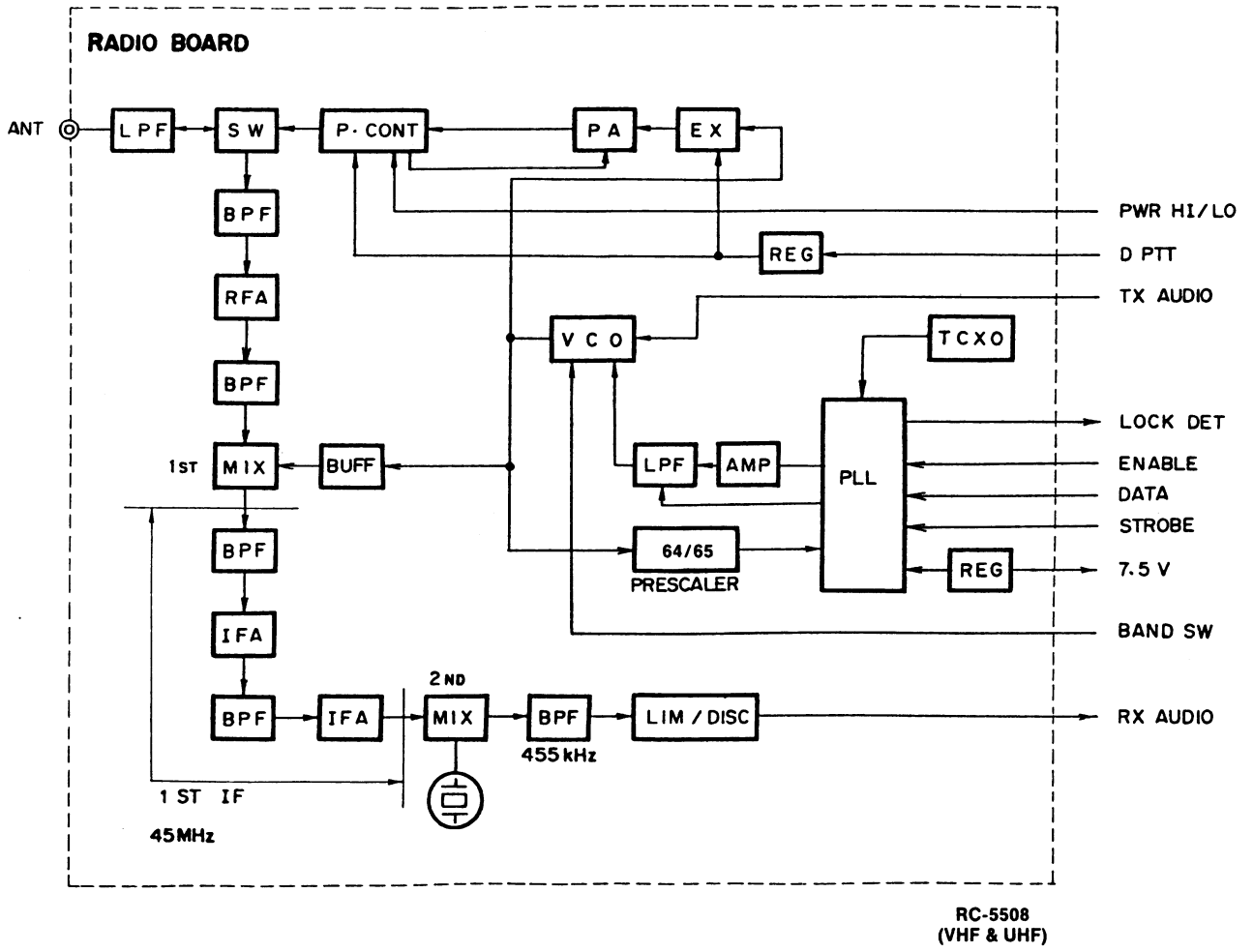



FIGURE 5 - RADIO BOARD BLOCK DIAGRAM

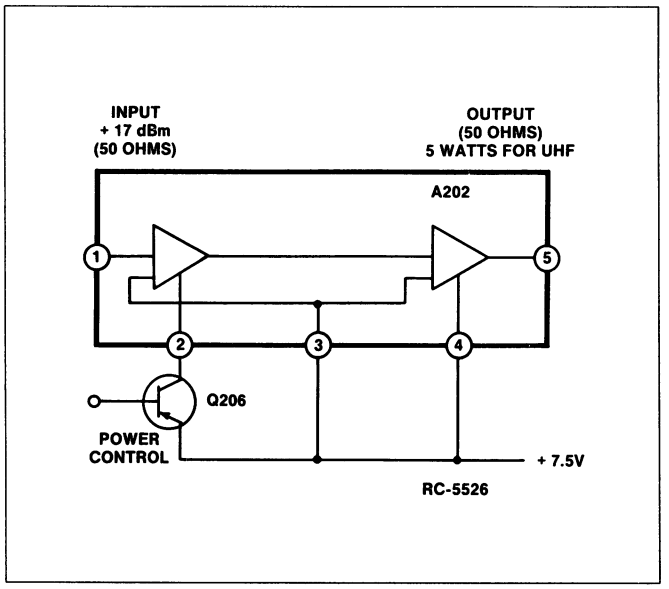



FIGURE 6 - POWER AMPLIFIER MODULE PA

Filter Network (FN):

The output of the PA module is connected to filter network FN through TX-RX switching diode CR201. The FN network is a passive LC low pass filter with an insertion loss of less than 0.5 dB in the pass band. It also has a rejection greater than 45 dB in the stop band. The output of the FN is connected to the system antenna.

Receive Circuit

The PLS receive circuit, as shown in Figure 5 - - Block Diagram consists of the following circuits:

- RF Amplifier/Mixer
- First IF Amplifier
- Second IF Amplifier/Discriminator
- RF Amplifier/Mixer:

The RF Amplifier/Mixer circuit contains two third order band pass filters (FL301 and FL302), an RF amplifier circuit (transistor Q301) and a double balanced diode mixer circuit (A301). Refer to Figure 8 - RF Amplifier/Mixer. RF from the antenna is coupled through transmit low pass filter FN and RF switching diode CR201 to the input of the RF amplifier circuit. Low pass filter FN is used in the receive circuit to provide additional receive selectivity. The RF signal on the input of the RF amplifier is first coupled through band pass filter FL301 to the input of grounded emitter, broad band RF amplifier transistor Q301. This amplifier provides 12 dB of power gain to reduce thermal noise. The output of the RF amplifier is coupled through band pass filter FL302 to drive double balanced mixer circuit A301.

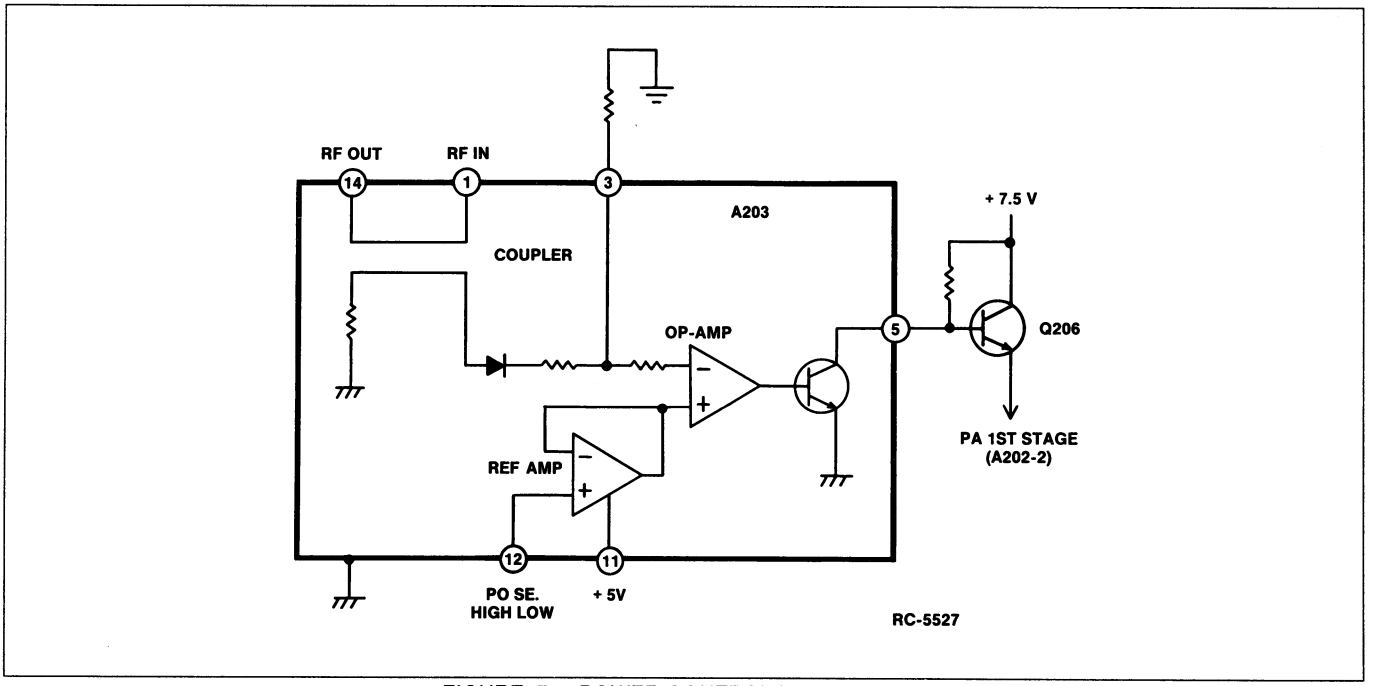



FIGURE 7 - POWER CONTROL MODULE (PC)

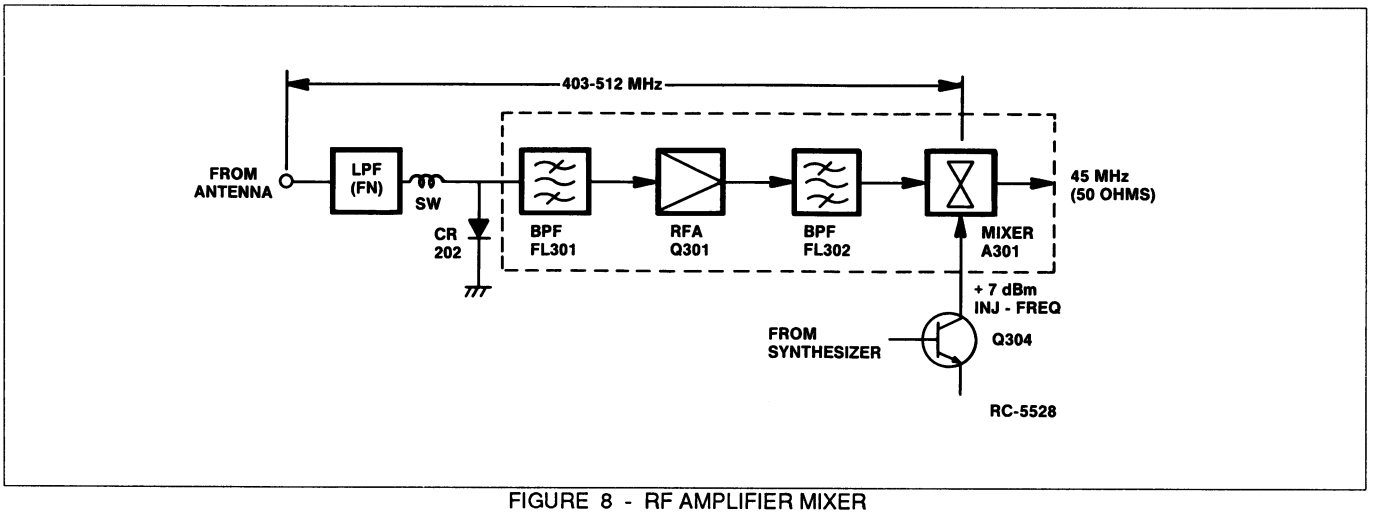



FIGURE 8 - RF AMPLIFIER MIXER

The RF signal from the RF amplifier and the injection frequency from the synthesizer circuit, provide a difference of 45 MHz IF on the output of the mixer. The double balanced Mixer has a typical conversion loss of 6 dB between the RF input and IF output. All inputs and the output of the RF Amplifier/Mixer have 50 ohms matching impedance. The +2 dBm injection frequency level, provided by the synthesizer and amplifier circuit transistor Q106, is connected to the injection frequency input through a 50 ohm matching circuit. The output of the Mixer circuit is connected to the input of the First IF Amplifier.

First IF Amplifier:

The First IF amplifier contains two amplifier circuits and two crystal filters of two and four poles respectively (refer to Figure 9). The first IF signal (45 MHz) from the first mixer circuit connects to the input of preamplifier transistor Q302 through pre-crystal filter FL303 with an impedance of approximately 3K ohms. Preamplifier Q302 provides a 17 dB power gain. The output is connected to the input of IF amplifier transistor Q303 through crystal filter FL304. IF amplifier Q303 has a 13 dB power gain, an input impedance of approximately 3K ohms and an output impedance of approximately 2.2K ohms.

Second IF Amplifier/Discriminator (A302):

The Second IF Amplifier/Discriminator circuit contains FM IF IC A302 (HA12442V) and 455 KHz ceramic filter FL305 (refer to Figure 10). The FM IF IC contains a local oscillator, mixer, IF amplifier, FM detector and an audio amplifier. The 45 MHz IF output from the first IF amplifier is connected to the input of second IF amplifier A302, Pin 2 and converted to the second IF frequency (455 KHz). The second IF is connected through the 455 KHz ceramic filter to the IF amplifier and FM detector circuits. The recovered audio from the FM IF IC is connected to connector J102-4.

Synthesizer Circuit

The synthesizer circuit contains Phase Lock Loop module (PLL) A102, TCX Reference Oscillator Module A105, TX/RX Voltage Controlled Oscillator module (VCO) A106 and a Low Pass Filter amplifier (LPF). Refer to Figure 11 - Synthesizer. The VCO used to generate the receive and transmit reference frequencies is phase locked to a stable TCX reference oscillator through the use of the PLL. This feedback loop divides the VCO frequency down to a signal in the range of 2 MHz - 7 MHz; divides this signal with a programmable divider to 12.5 KHz and generates a VCO control signal by comparing the 12.5 KHz feedback with a 12.5 KHz derived by dividing a 12.8 MHz VCTCXO by 1024. As the least significant bit in the programming is changed, the VCO is forced to change by 12.5 KHz.

Phase Lock Loop Module (A102):

The PLL module A102 contains a reference frequency divider, phase detector and a programmable divider. The phase detector DC voltage output signal is filtered with a passive low pass filter followed by a 12.8 KHz filter to reduce the level of reference modulation on the VCO. This DC output represents the error between the VCO frequency (phase) and the reference (TCX) and is applied to the VCO on frequency.

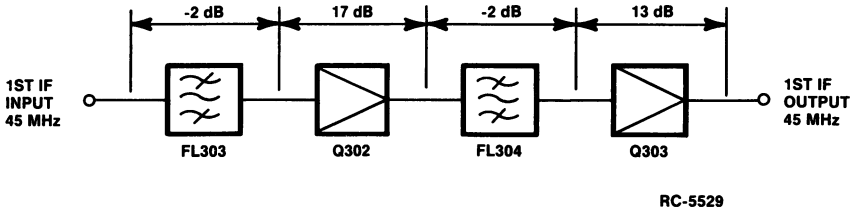



FIGURE 9 - FIRST IF AMPLIFIER

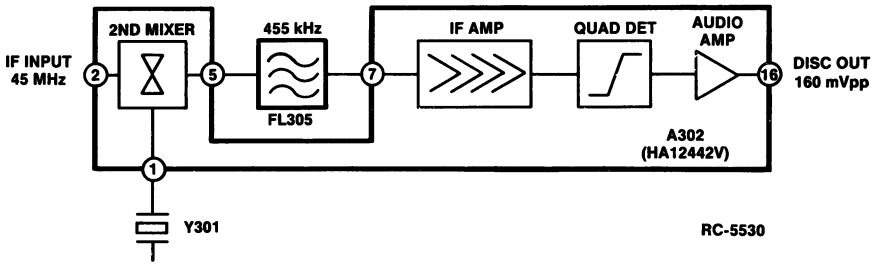



FIGURE 10 - SECOND IF AMPLIFIER/DISCRIMINATOR

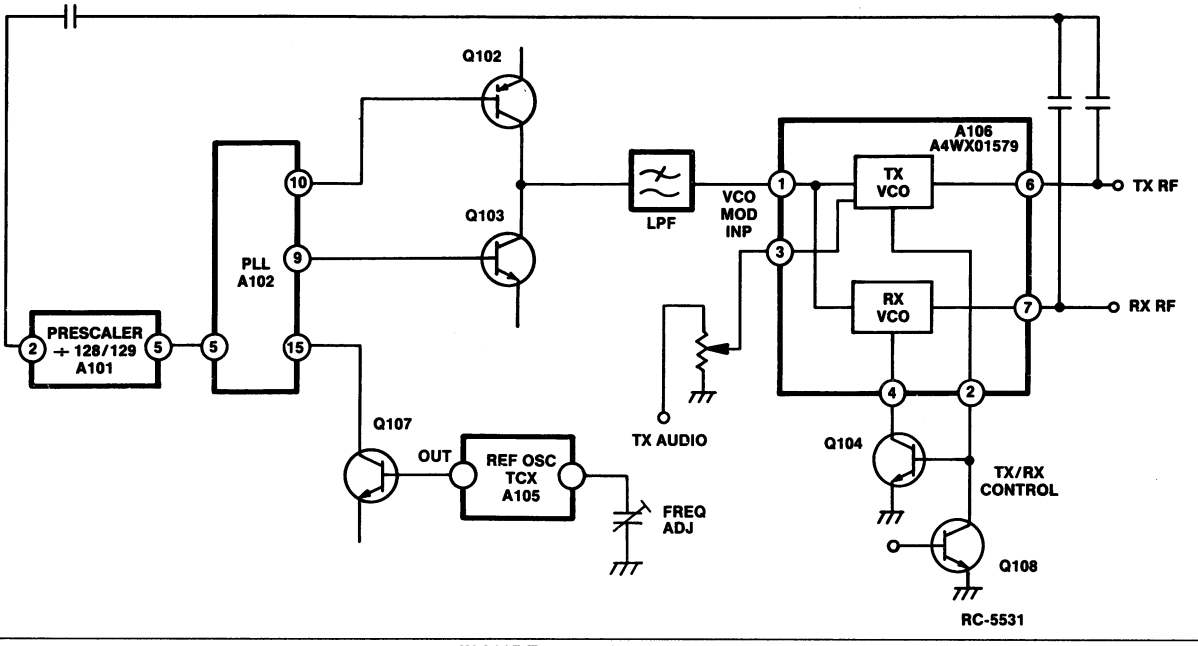



FIGURE 11 - SYNTHESIZER

Serial data from the microprocessor is shifted into the PLL to set the division parameter which establishes the frequency. A clock signal is provided on another input and the data is locked with the enable input.

Voltage Controlled Oscillator (A106):

The VCO uses a low noise, high gain transistor as the basic oscillator. the resonant circuit, which determines the frequency of oscillation, is formed by a dielectric resonator which is used to set the center frequency at the factory. The output of the RX-VCO amplifier is coupled into the receive circuit first double balanced mixer circuit A301 through buffered amplifier Q304. The TX-VCO amplifier output is directly connected to the TX-Amp circuit input through an attenuator circuit: resistors R209, R210 and R211.

TCX Reference Oscillator (A105):

The A105 oscillator module is self contained, fully temperature compensated and operates at a frequency of 12.8 MHz. Frequency is adjusted by a trimmer while monitoring the transmit circuit output at the antenna connector.

## CONTROLLER

This controller circuit consists of control circuits and audio circuits (see Figure 12 - Control Circuit Block Diagram). Physically, this circuit consists of three circuit boards as follows:

- Control Board
- Display and Switch Board
- Key Pad

Control Board

The Control Board consists of the following circuits:

- CMOS Microprocessor (A6)
- RAM With Lithium Battery (A7 plus BT1)
- Audio Processor (A9)
- Audio Amplifier (A4, A5 & A6)
- Voltage Regulator Circuit (A1 & A2)
- External Buffer (A4 (1/4))
- LCD Driver (A8)

Microprocessor A6):

The microprocessor provides various software for controlling the radio unit as follows:

- Loading data to the frequency synthesizer
- Fetching and processing the PTT, monitor, channel selection and volume control, etc.
- Loading data to the LCD display
- Controlling the audio circuit (processor).
- Encoding /decoding the squelch, Channel Guard.
- Controlling the load interface for the radio data (channel data, etc.)

RAM (A7):

RAM has a capacity of 8 bits X 2K for storing various data for controlling the radio. The data is entered from the outside to the microprocessor through the jack connectors and then to the RAM. The data mainly consist of the following

- Channel Frequency Data
- Channel Guard Data
- TX Power, TX Modulation Data
- Squelch Data
- Display Data...etc.

Audio Processor (A9):

Audio processor (A9) consists of a single chip IC accommodating almost all of the audio functions. The audio functions are under control of the microprocessor in compliance with the function of the radio. The functions of the audio processor are as follows:

- Tone Reject Filter
- Limiter Amplifier
- Post Limiter Filter
- Squelch Filter and Rectifier
- Channel Guard Encode/Decode Filter and Limiter
- Digital/Analog Converter and Comparator
- Oscillator Circuit and Digital Interface for the Microprocessor

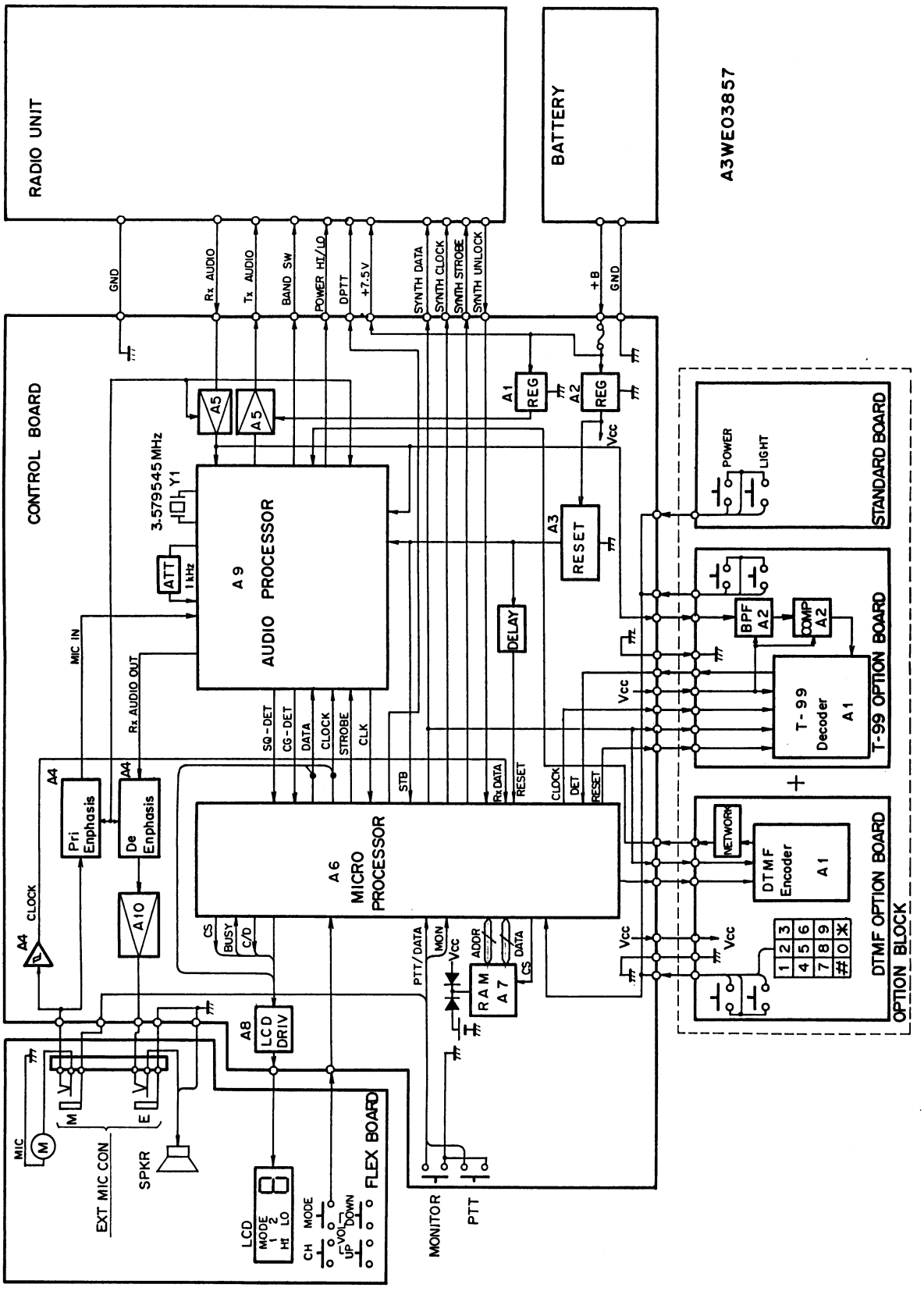



FIGURE 12 - CONTROL CIRCUIT BLOCK DIAGRAM

All of these functions are made up of switched, capacitor filters, amplifiers and timing logic. The timing for this logic is derived from the 3.379545 MHz clock generator. The clock signal is also applied to the microprocessor.

Audio Amplifiers (A4, A5 & A10):

These audio amplifiers are located between the audio processor and the microphone or the speaker. Amplifier A4 provides pre-emphasis for transmit audio and de-emphasis for the receive audio. Amplifier A10 amplifies the output signal of A4 to the level adequate for driving the speaker.

Voltage Regulator Circuit (A1, A2):

Voltage Regulator Circuit A1 and A2 provides a regulated +5 VDC supply for the Control Board.

External Data Buffer (A4 (1/4)):

External Data Buffer A4 (1/4) is located between the jack connectors on the side of the radio and the microprocessor. This buffer is used for converting the level of external signals to match the internal circuits. This buffer also provides protection of the internal circuits.

LCD Driver (A8):

LCD Driver A8 converts data from the microprocessor into a signal which can drive the LCD display.

## LCD Board

The LCD Board is composed of the following items:

- LCD
- Back Lighting Circuit (CR1)
- Switch (S1, through S4)

The LCD board is equipped with a three segments, one digit and five status display. Microprocessor signals drive the LCD driver, located on the Control Board. The LCD driver turns the LCD on. Also, the LCD board is equipped with a back lighting circuit to light the dark area with LED light upon receiving a signal from the microprocessor. The microprocessor produces this signal by the operation of a switch (VOLume up and down, MODE and CHANnel).

## Key Pad

There are two types of key pads. One is a two key pad used with the standard PLS radio and a PLS radio equipped with a Type 99 option. The other key pad is a 16 key pad, used with a PLS radio equipped with a DTMF or a Type 99/DTMF option. The key pads consist of a key pad board and rubber contacts.

## Jack Connector

Jack connectors are located on the side of the main frame, so external MIC and external earphone can be supplied. The are also used as TX data and RX data for the suit case programmer. Connecting signals are as follows:

- External MIC/TX data
- External Speaker/RX data
- PTT

## Battery Pack

Two battery packs, one with 800 mAh capacity and one with 1200 mAh capacity are available for use with the PLS radio. Both battery packs provide a nominal 7.5 VDC output.

To protect the battery pack from external short circuits, the positive (+) charging contact is diode protected (see Figure 13).

An internal thermistor senses variations in battery pack temperature to automatically control a charger and provide a maximum charge without overheating the battery pack. Both battery packs can be charged in one hour.

The battery pack is shipped fully charged to the customer, ready for use. However, if the battery pack is stored for any length of time, it should be fully charged before placing in to service.

Charger combinations for charging battery packs are available with charge times of 1 hour and 16 hours. A combination can be a single unit desk or a vehicular charger. It can also be a wall mounted multiple charger with the capability of charging up to five battery packs simultaneously.

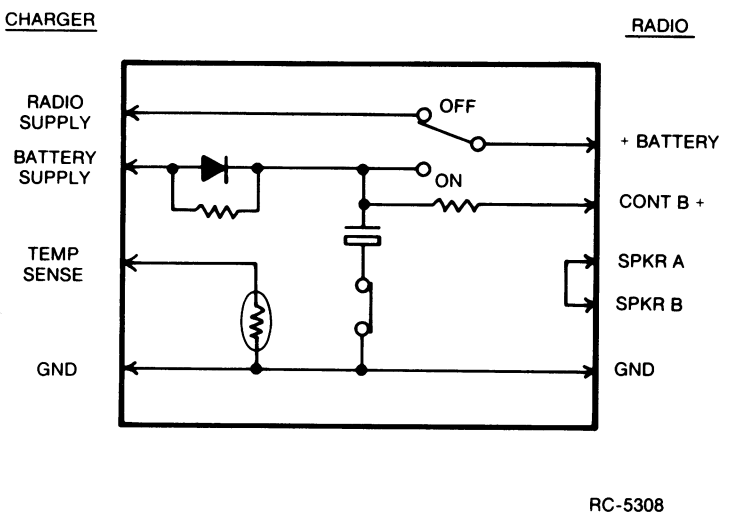



FIGURE 13 - BATTERY PACK

## Charge Level

A fully charged battery pack should provide a terminal voltage greater then 7.5 VDC. A fully discharged battery pack should provide a reading of no less than 6 VDC.

## Battery Check

One of the best service checks for the series rechargeable battery packs can be easily obtained by measuring the milliampere hour capacity. The results of the measurement can then be compared with the rated capacity of the battery pack to determine the general condition of the rechargeable batteries.

First, it is necessary to find the percentage of rated capacity. This is obtained by measuring the time it takes to discharge a fully charged battery pack until the terminal voltage drops to 6 volts. The proper load resistor for each of the battery packs is shown in Table 1.

Then use the formula

**T/60 = %**

Where "T" is the time in minutes required to discharge the battery pack to 6 volts and % is the percentage of rated capacity the battery delivered to a load. For example: assume the standard battery pack voltage dropped to 6 volts in 65 minutes:

**65/60 = 108 (percent of capacity)**

Now multiply the percentage of capacity by its rated capacity (see Table 1):

**108 X 800 mA = 864 mAh**

The 864 milliampere hour is the actual capacity of the battery pack.

**NOTE**

As the voltage drops very fast near the end of the discharge cycle, be very careful to avoid discharging the battery pack below 6 volts.

**Table 1 - Capacity Measurement Data**

| Rechargeable Battery Pack | Rated Capacity | Average Discharge Rate (for 60 minutes) | Load Resistor | End Voltage |
|---|---|---|---|---|
| (6 cells) | 800 mAh | 800 mAh | 9.375 ohms 8 Watts | 6 VDC |
| (6 cells) | 1200 mAh | 1200 mAh | 6.25 ohms 12 Watts | 6 VDC |

## MAINTENANCE

This Maintenance section provides information on adjustments of the radio (transmit, receive and synthesizer), preventive maintenance and a Disassembly Procedure. Information is also provided for removing and replacing chip components and module replacement. The Service Section, called for on the front cover of this manual, provides a more complete set of alignment procedures for the radio plus a detailed Troubleshooting Procedure.

### Initial Adjustment

After the radio has been programmed, as described in Programming Instructions (LBI-31745), the following adjustments should be made by a certified electronics technician.

Transmit Circuit Alignment:

The transmit circuit is factory tuned and should not require any readjust. The frequency and modulation should be measured and recorded for future reference.

Receive Circuit:

No initial adjustments to the receive circuit are required.

Synthesizer Circuit:

No initial adjustments to the synthesizer are required.

**WARNING**

To prevent loss of memory in RAM A2 on the Controller Board, lithium battery BT1 should be replaced at three years. A procedure for changing BT1 is provided in Service Section LBI-31790.

### Preventive Maintenance

To ensure a high operating efficiency and to prevent mechanical and electrical failures, routine checks should be performed for all mechanical and electrical parts at regular intervals. Preventive maintenance should include the following checks:

Antenna:

The antenna and antenna contact should be kept clean, free from dirt or corrosion. If the antenna or contact should become dirty or corroded, loss of radiation and a weak signal will result.

Mechanical Inspection:

Since portable radio units are subject to irregular shock and vibration, check for loose plugs, nuts, screws and other parts to make sure that nothing is loose or is working loose.

Alignment:

The transmit and receive circuit meter readings should be checked periodically and the alignment "touched up" when necessary. Refer to the Service Section for the applicable alignment procedure and troubleshooting sheet for typical voltage reading found in the Service Section.

Frequency Check:

Check transmit frequency and deviation. Normally, these checks are made when the unit is first put into operation. They should be repeated after the first month of operation, then again one time each year.

## Disassembly

To gain access to the Radio Board (transmit, Receive and synthesizer circuits) or Control Board for servicing, loosen the captive screws and disassemble as follows:

| | |
|---|---|
| Radio | Step 1 then step 2 |
| Controller Board | Step 3 then step 4 |

Disassembly Procedure (See Figure 14):

**CAUTION**

ALWAYS remove the battery pack before removing any component board to avoid blowing the fuse.

Equipment Required:

- Small #1 Phillips-head screwdriver
- Small jeweler's Phillips-head screwdriver
- Small flat-blade screwdriver
- Needlenose pliers
- Special tool for removing jack nuts.
- Pencil-type soldering iron (25-40 Watts) with a fine tip

**Step 1:**

**To gain access to the radio,** loosen, but do not remove, the four screws at (A).

**NOTE**

Screws are **not** captive, so be careful not to lose them.

Carefully remove the back cover. For normal radio alignment, the back cover is all that need be removed. When tightening the screws, they should be no tighter than 4 + 0.5 inch-pounds (See Figure 15).

**Step 2:**

**To Remove the Radio Board,** use the Phillips-head screwdriver and remove the two (8) screws at (B). Remove the RF shield cover at (C) (See Figure 16).

**Step 3:**

The radio portion can now be detached from the rear cover. Remove the ten (10) screws at (D). Remove the two (2) screws at (E). Unsolder the wire connected to the antenna connector at (F). Remove the radio board from the housing (see Figure 17).

**Step 4:**

**To remove the Controller Board,** use the Phillips-head screwdriver and remove the five (5) screws at (G) from the controller board and remove the shield at (H). Remove one (1) screw at (I) (See Figure 18).

**Step 5:**

Remove the two (2) nuts holding the External Microphone/Speaker Jacks at (J). Remove the four (4) screws at (K). Unsolder the flexible printed wire board from the speaker at (L). Peel out the tape at (M). Remove the flexible printed wiring board from the front housing. The controller Board can now easily be removed from the front housing (see Figure 19).

**Step 6:**

**To remove the Key Board, use the special tool.** Using the Phillips-screwdriver, remove the four (4) screws at (N). The speaker can now be removed from the housing.

## Replacement of Components

The major components of the PLS Personal Radio are the PA (Power Amplifier Module), PC (power Control Module), VCO (Voltage Controlled Oscillator) and the TCX (Ref. Osc.). These are very reliable devices and will not normally need to be replaced. Before replacing any of these modules, always check out the associated circuitry carefully.

To remove any of these major components, refer to the applicable replace procedure found in the Service Section (LBI-31790).

## Troubleshooting Procedure

Maintenance of the PLS Personal Radio is facilitated by using the Troubleshooting Procedures and service techniques unique to this radio. The Troubleshooting Procedures are designed to quickly lead the service technician to the defective component or circuit. These procedures are found in the Service Section.

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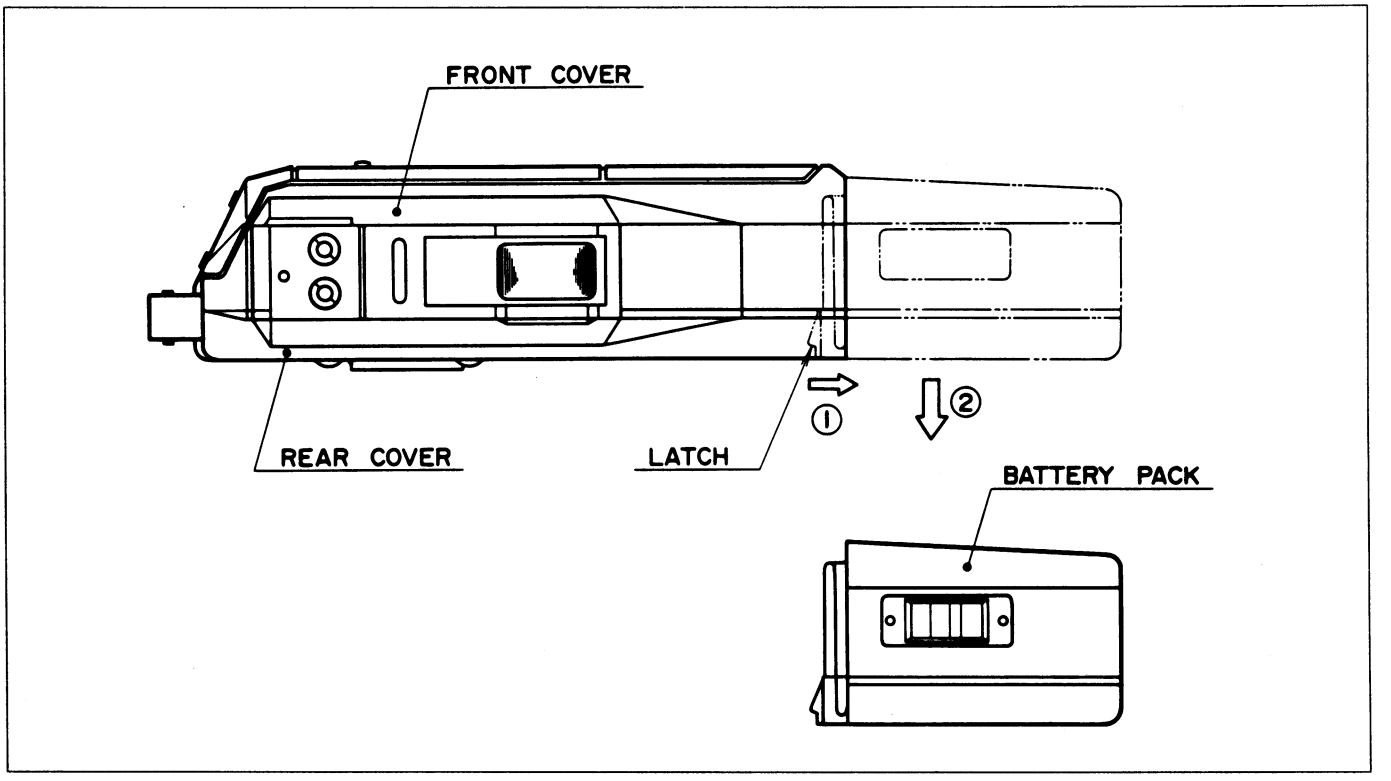



FIGURE 14 - DISASSEMBLY

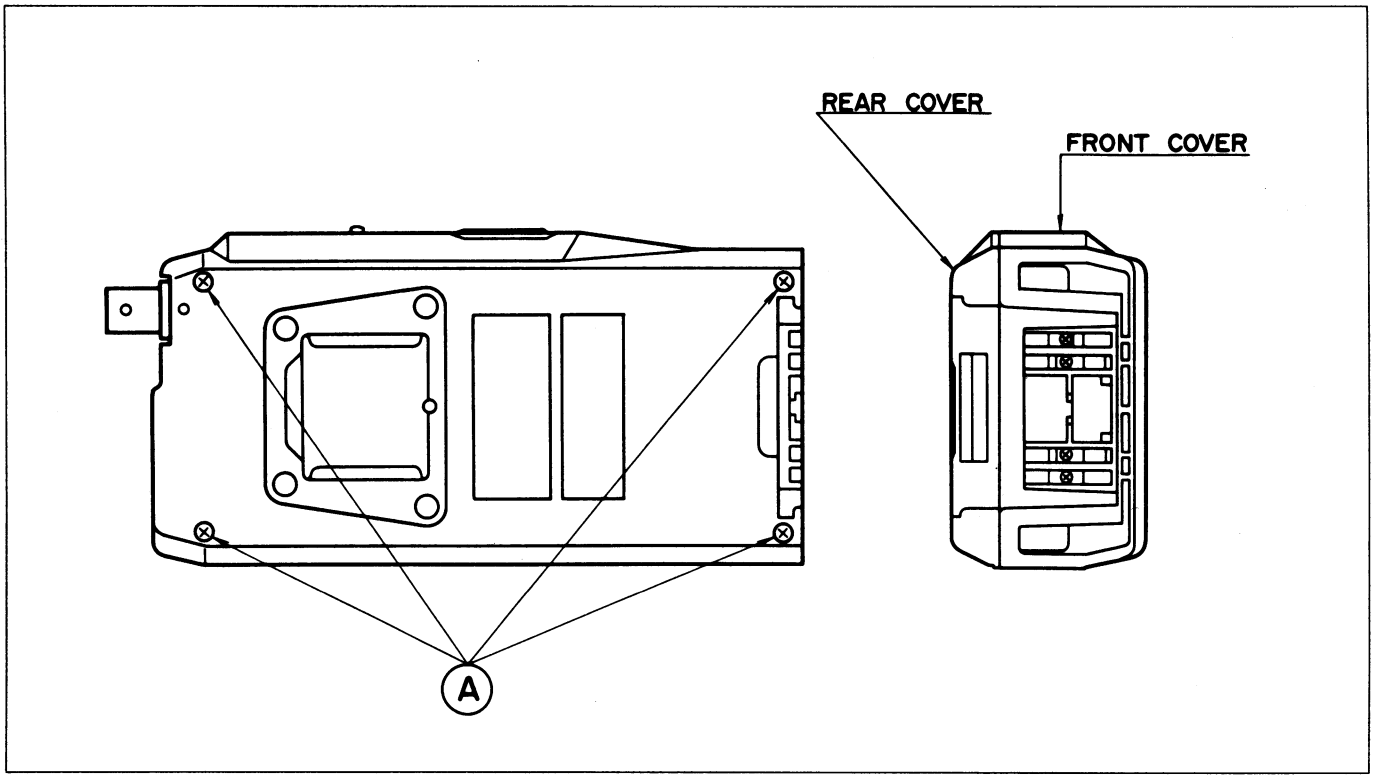



FIGURE 15 - DISASSEMBLY STEP 1

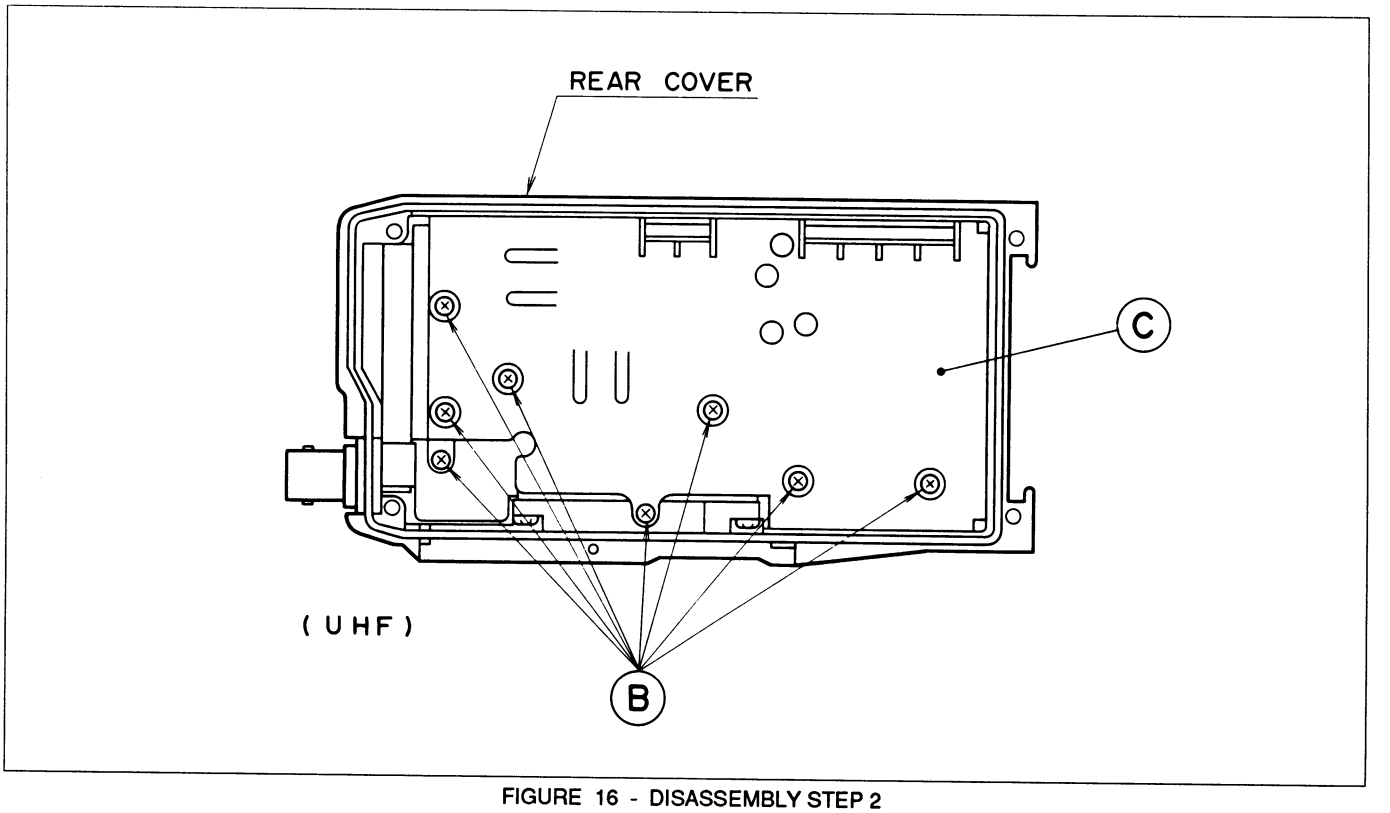



FIGURE 16 - DISASSEMBLY STEP 2

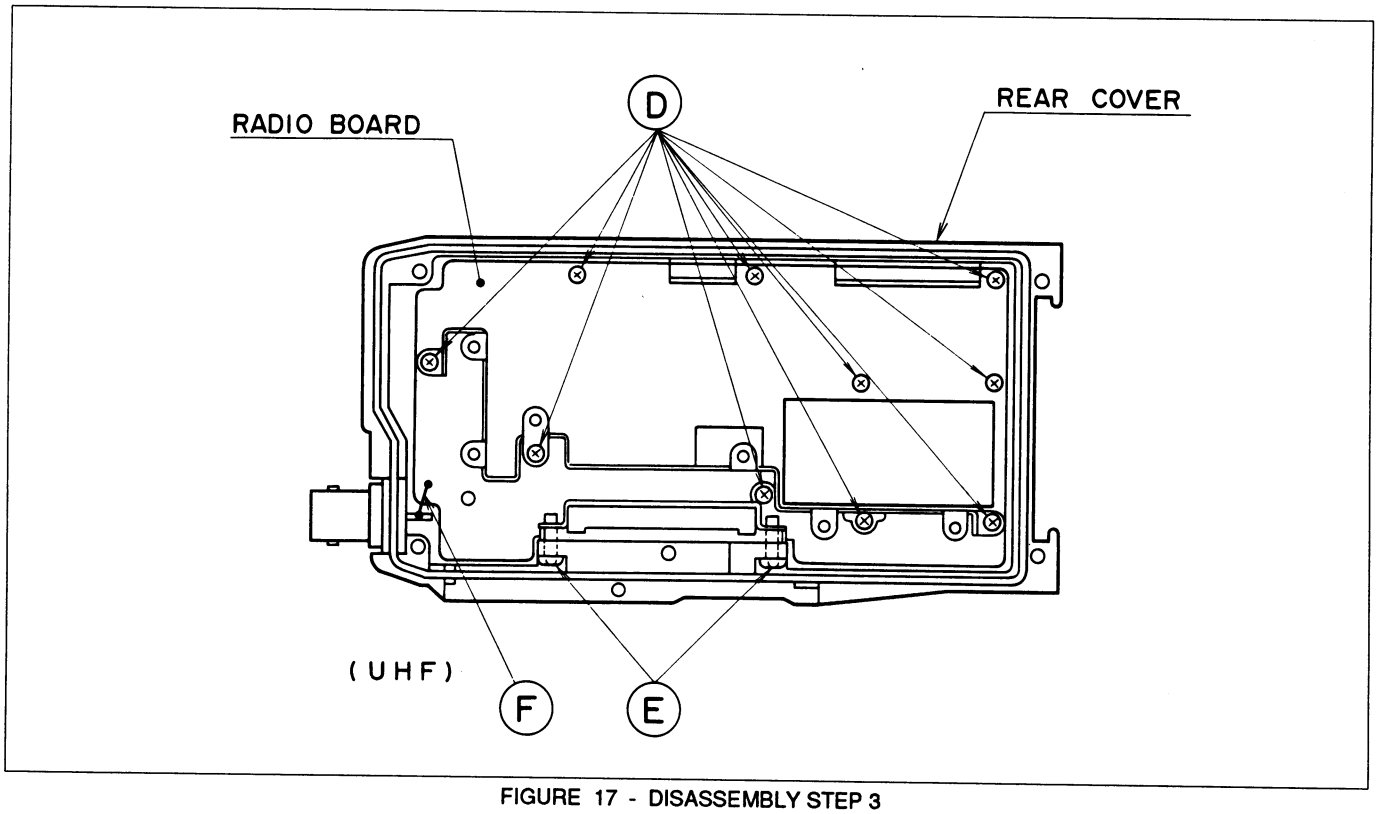



FIGURE 17 - DISASSEMBLY STEP 3

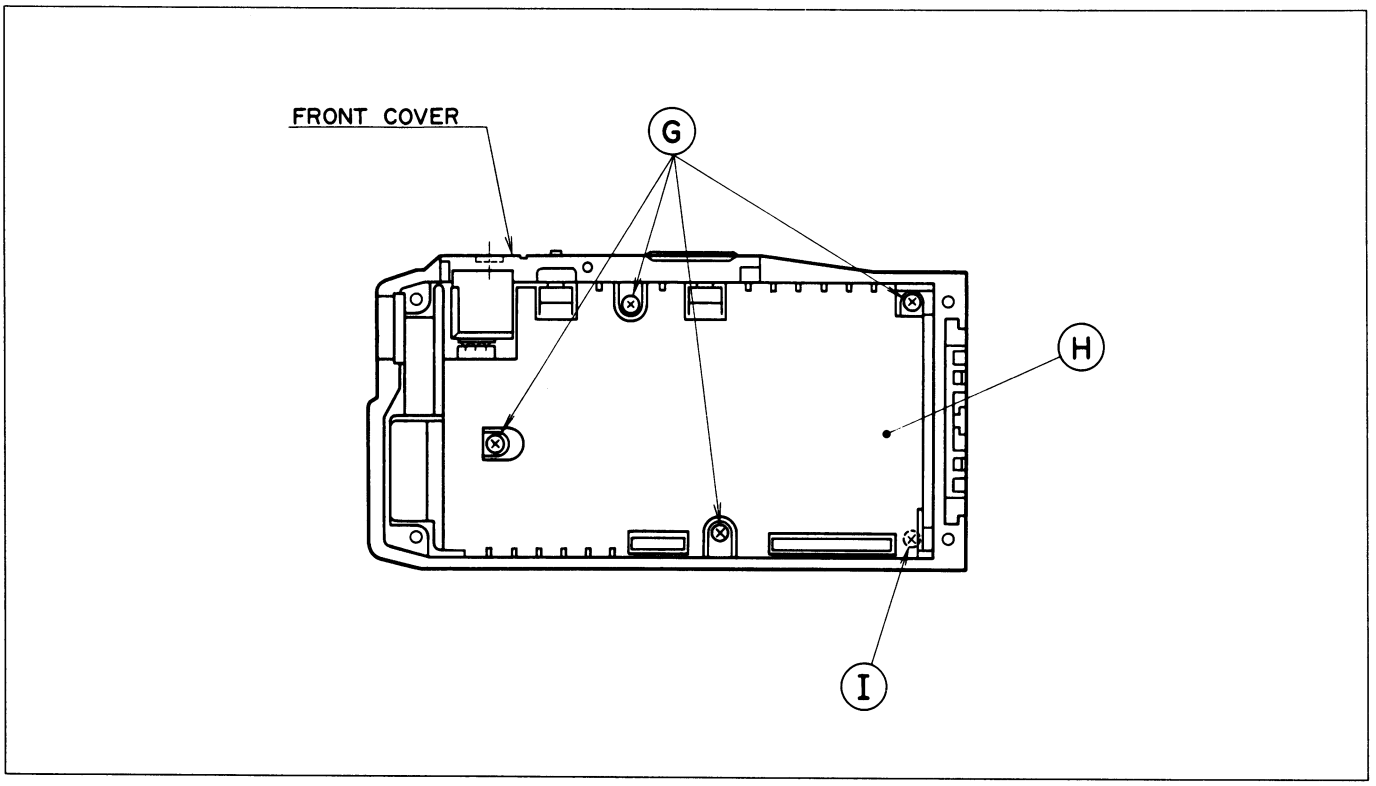



FIGURE 18 - DISASSEMBLY STEP 4

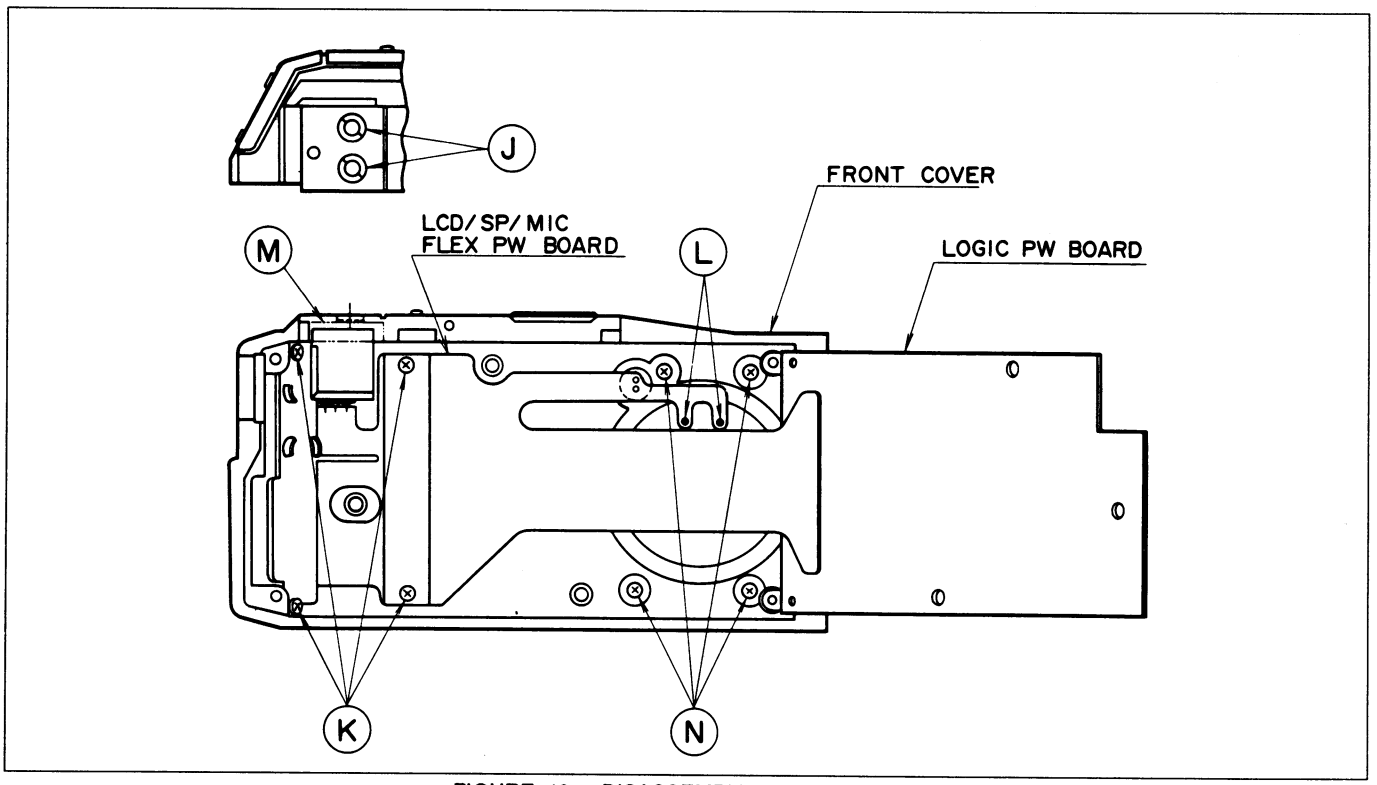
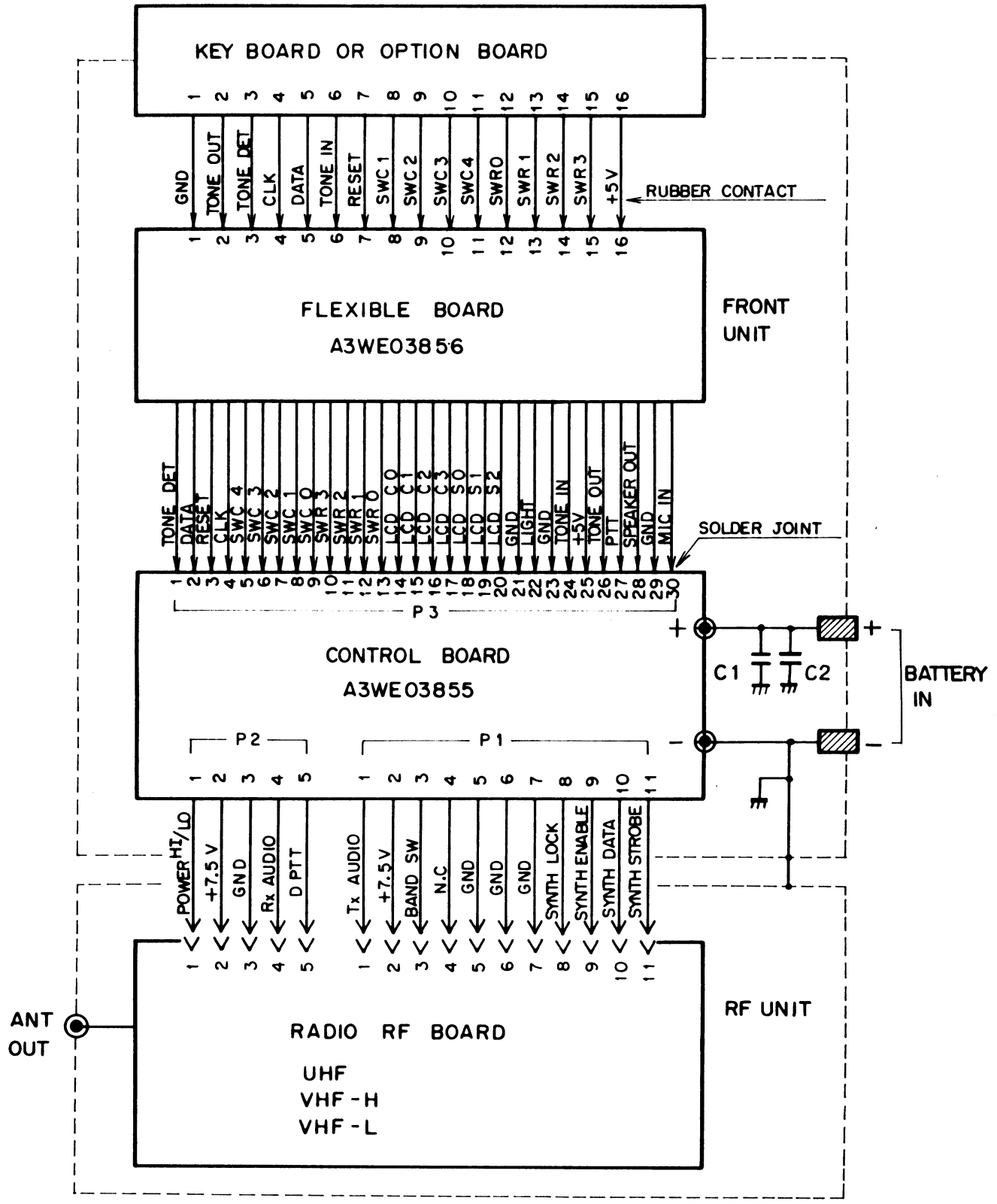
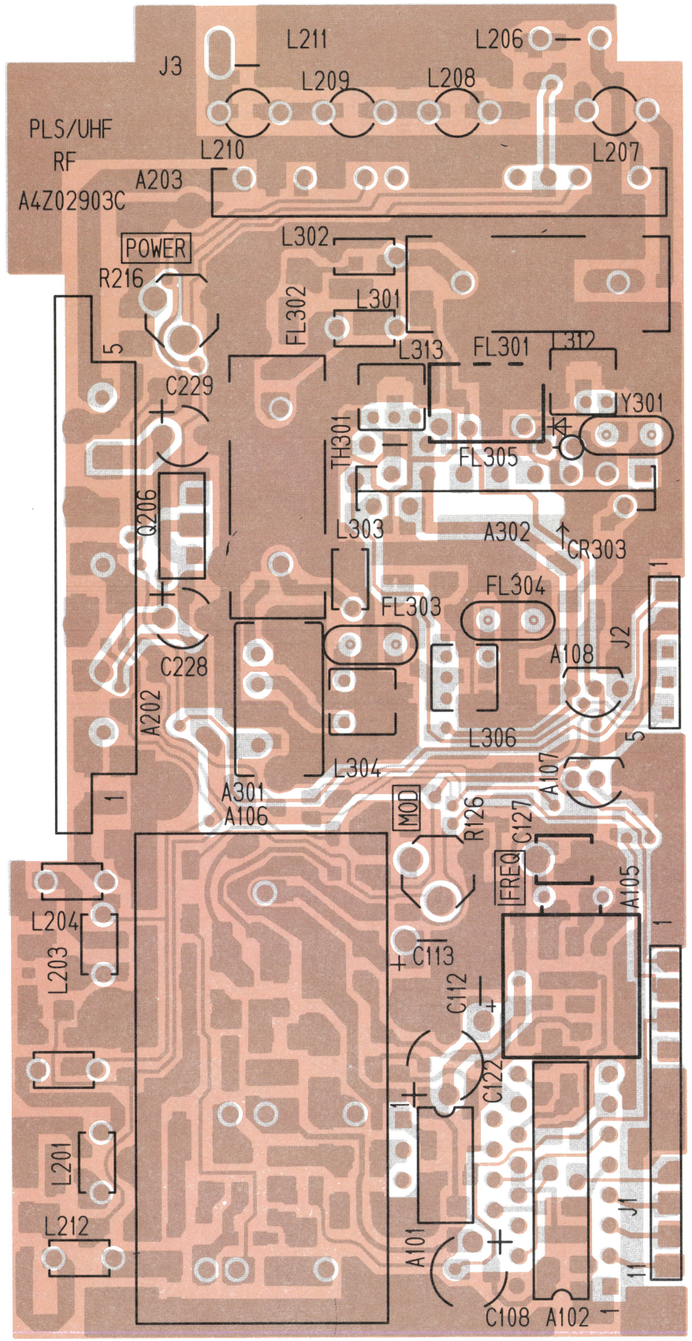



FIGURE 19 - DISASSEMBLY STEPS 5 AND 6



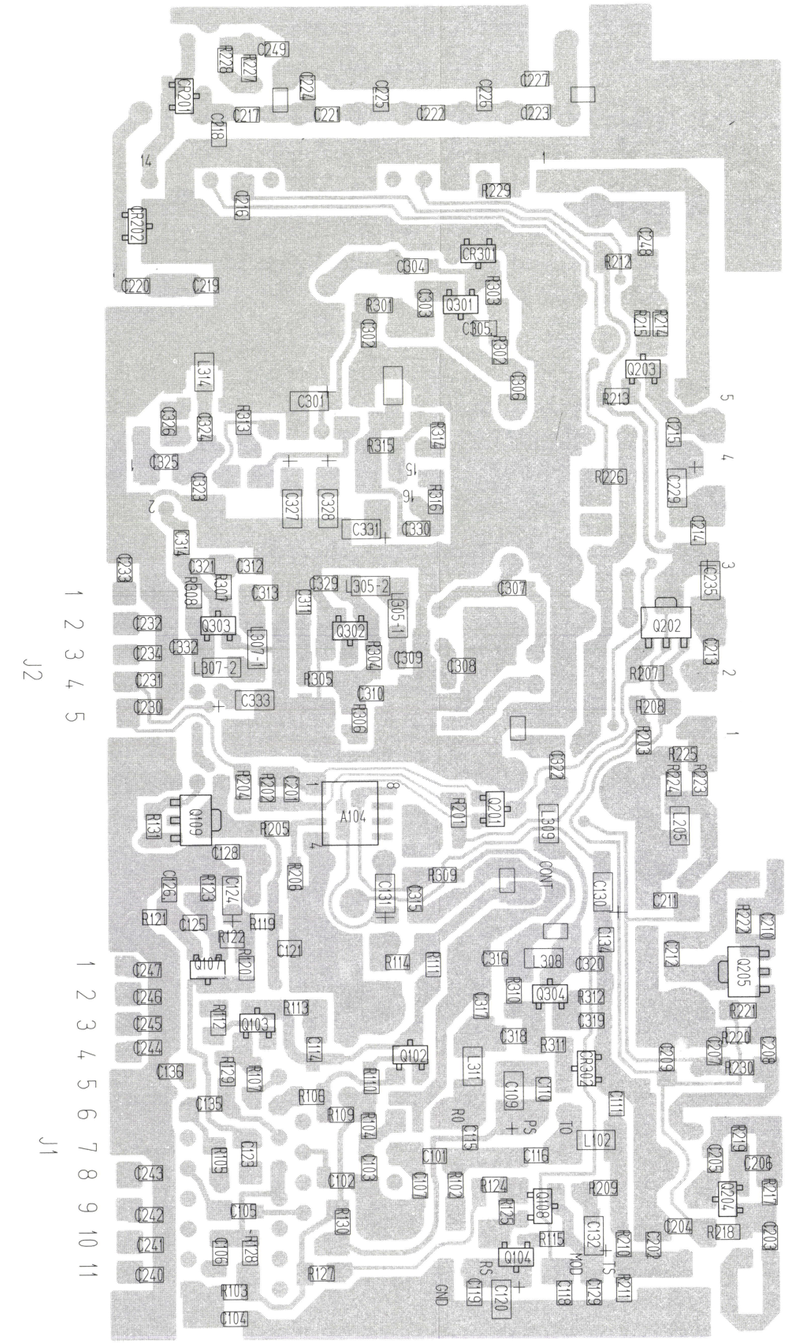

A3WE04059 Issue 1

## COMPONENT SIDE

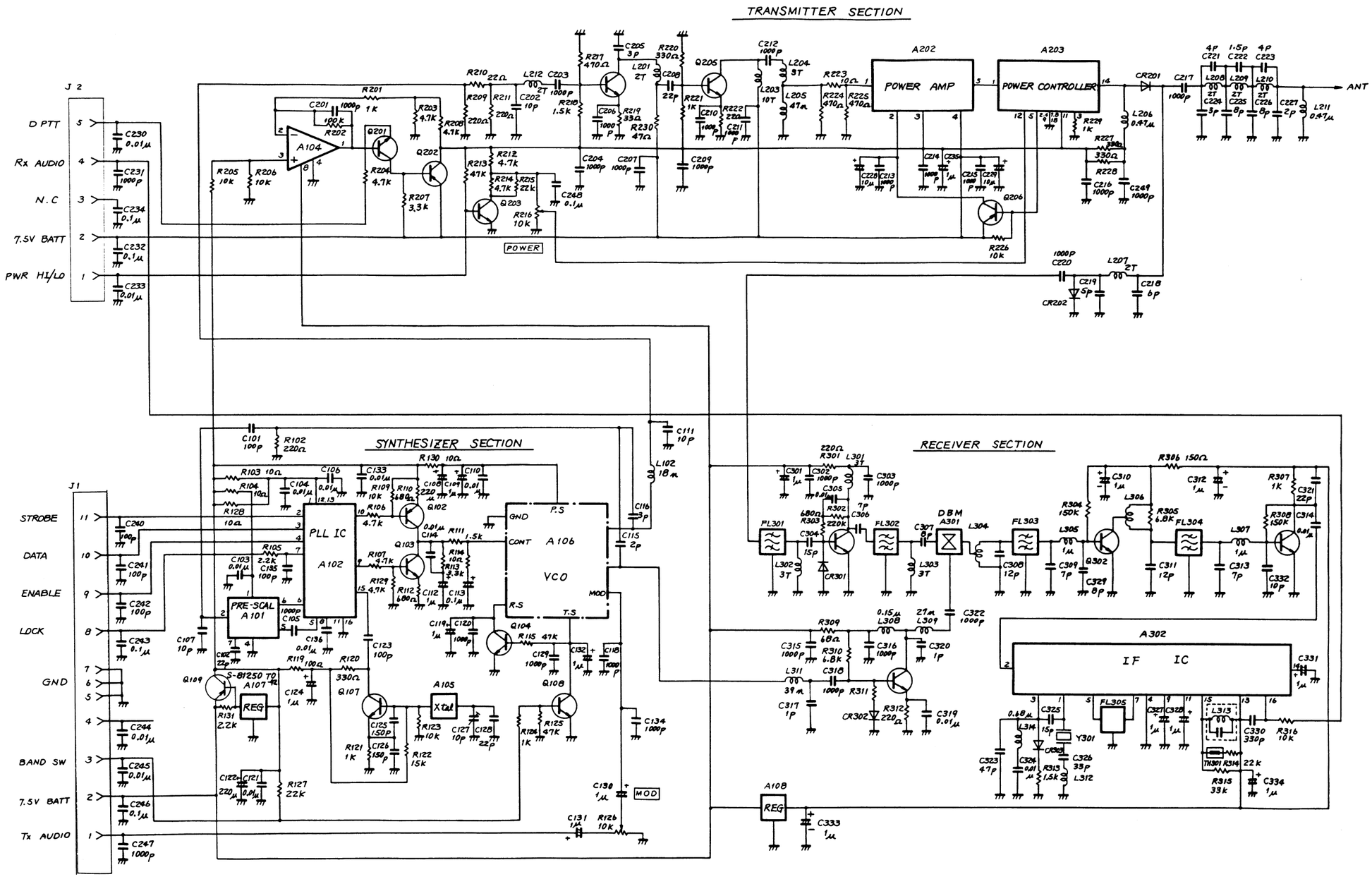



RUNS ON SOLDER SIDE
RUNS ON BOTH SIDES
RUNS ON COMPONENT SIDE

## SOLDER SIDE

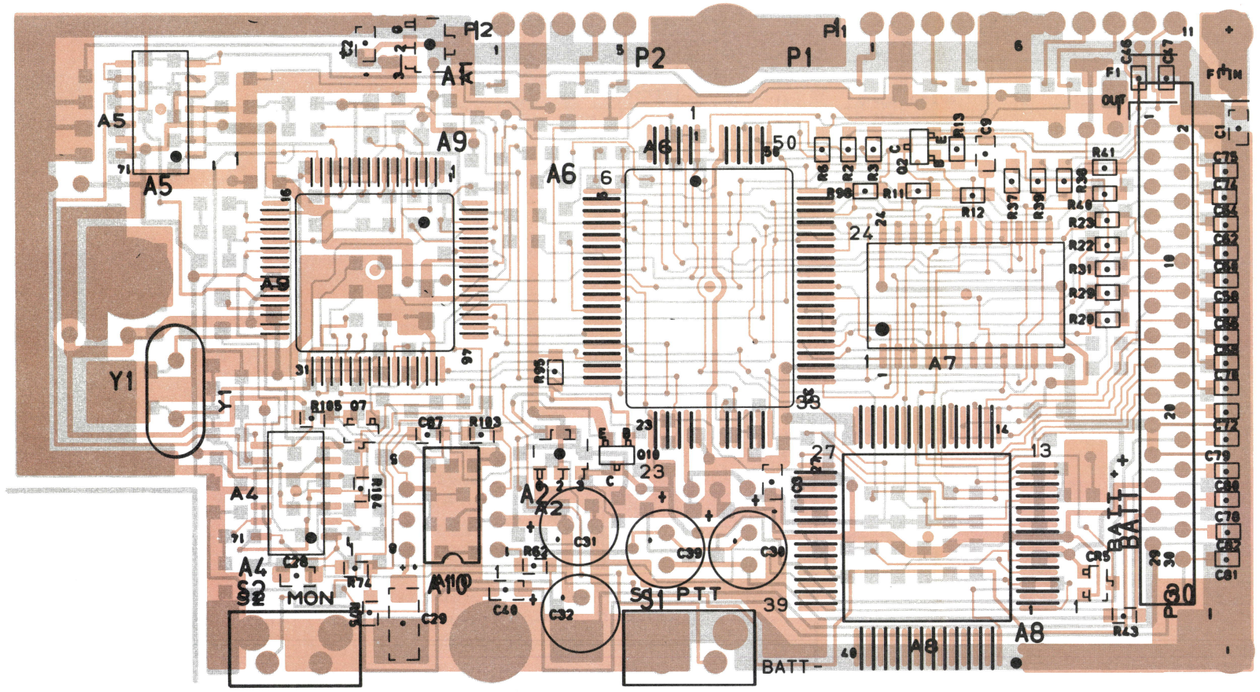



RADIO BOARD
A4Z02903C

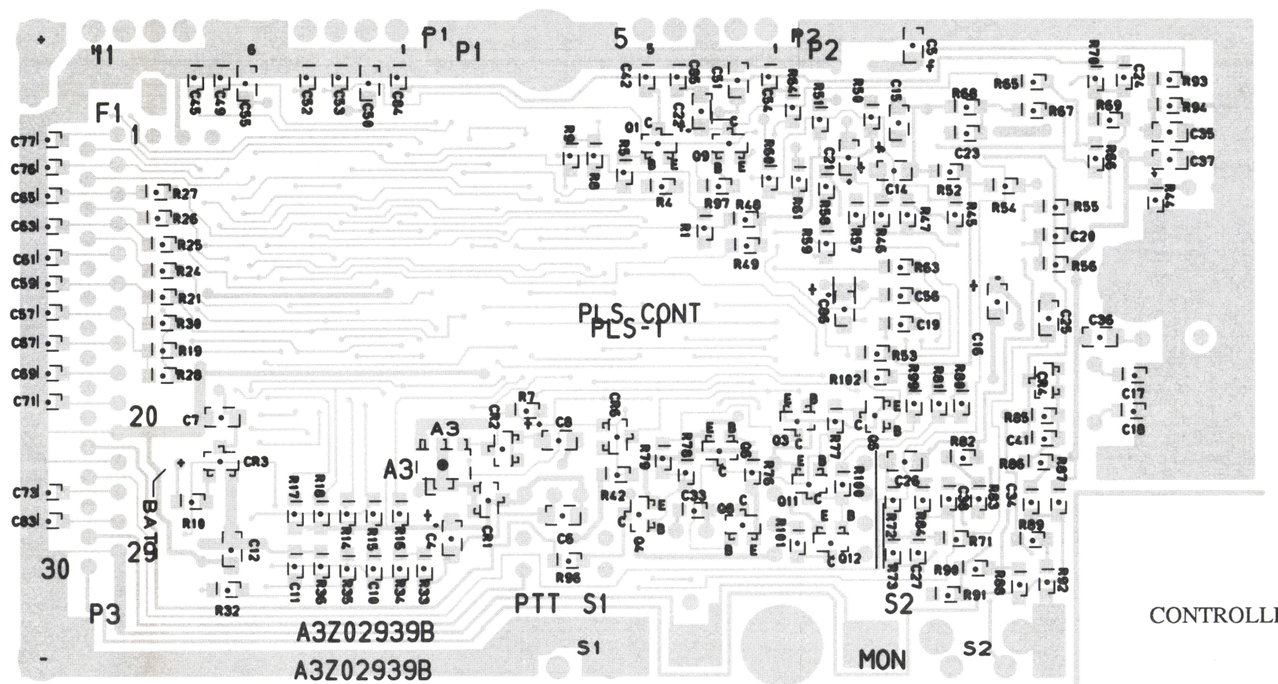



RADIO BOARD
A4Z02903C

## COMPONENT SIDE

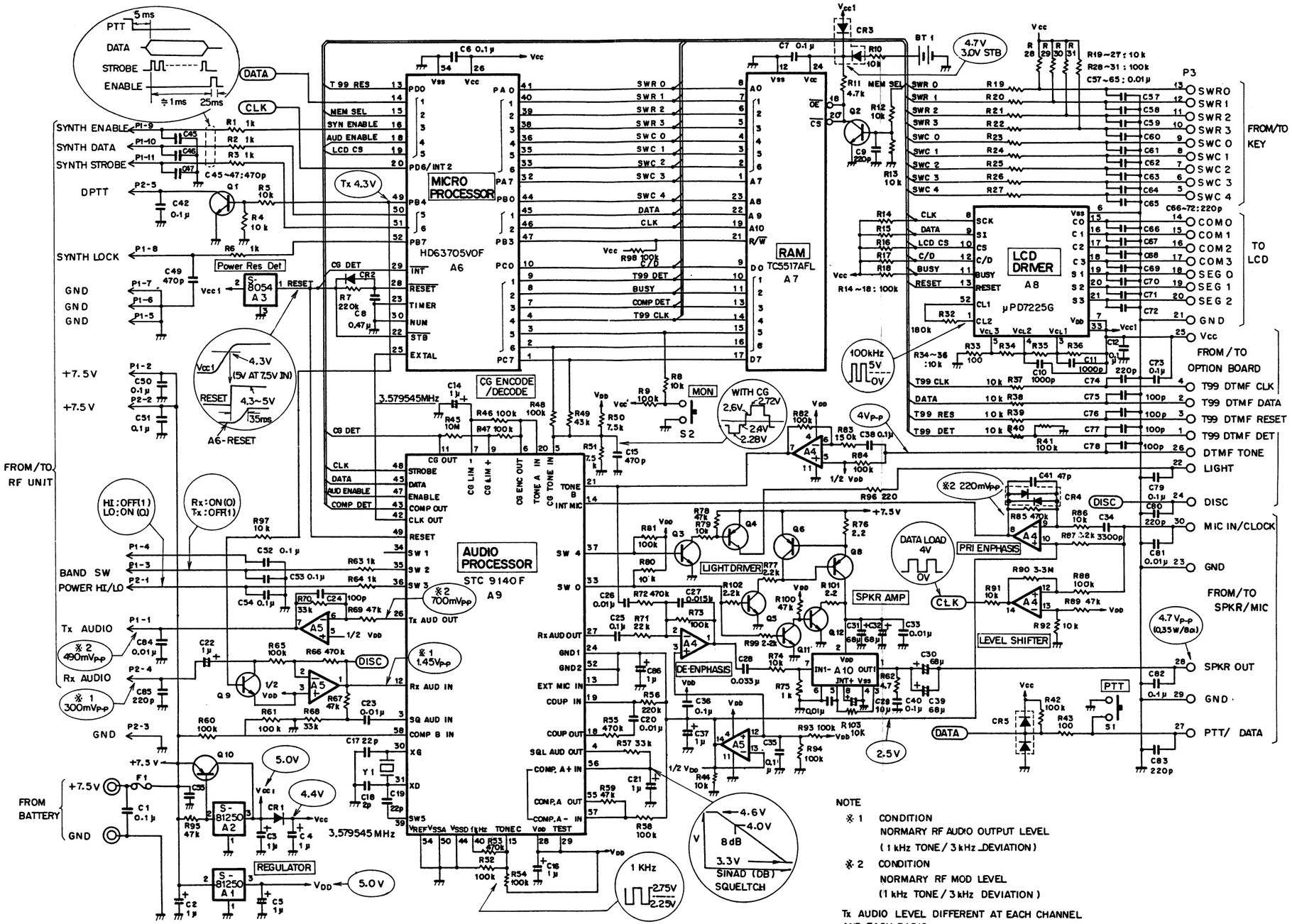



## SOLDER SIDE




CONTROLLER BOARD

RUNS ON SOLDER SIDE
RUNS ON BOTH SIDES
RUNS ON COMPONENT SIDE



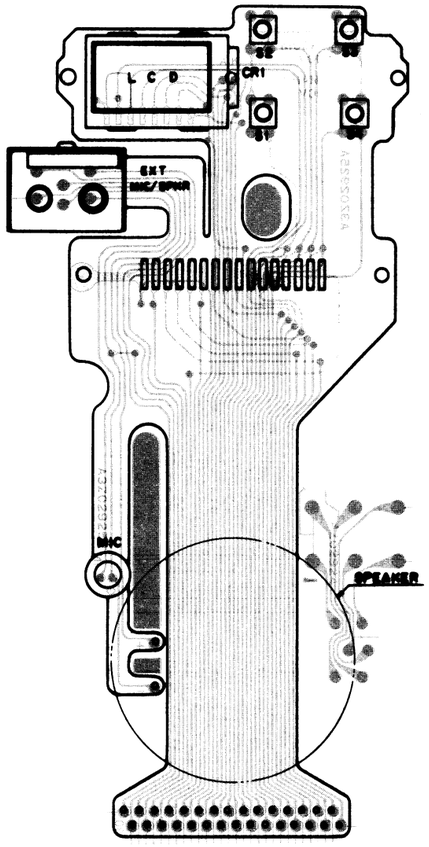

NOTE

※1 CONDITION
NORMARY RF AUDIO OUTPUT LEVEL
( 1 kHz TONE / 3 kHz DEVIATION )

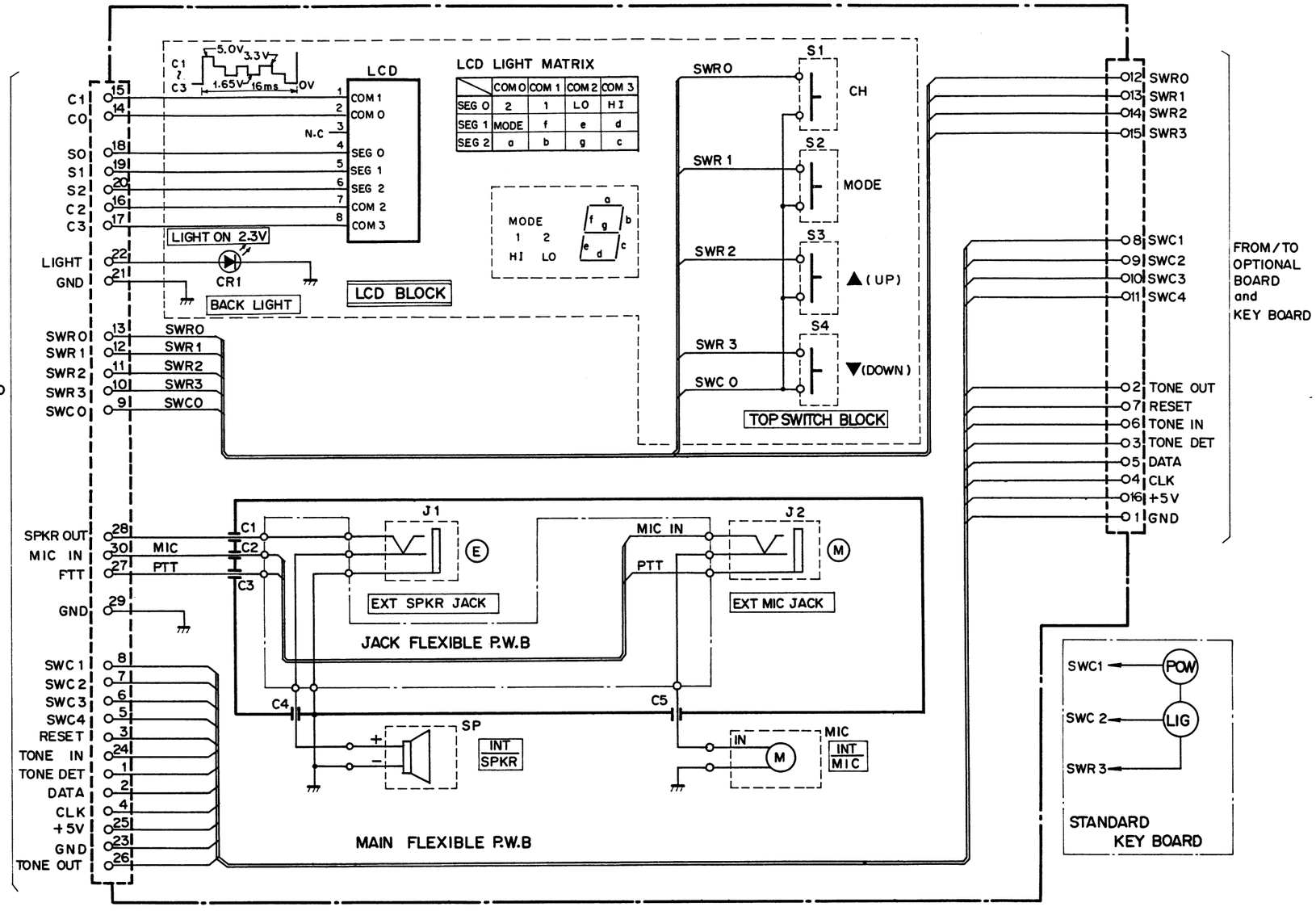
※2 CONDITION
NORMARY RF MOD LEVEL
(1 kHz TONE / 3 kHz DEVIATION )

Tx AUDIO LEVEL DIFFERENT AT EACH CHANNEL AND EACH RADIO

CONTROLLER BOARD
AWE03855

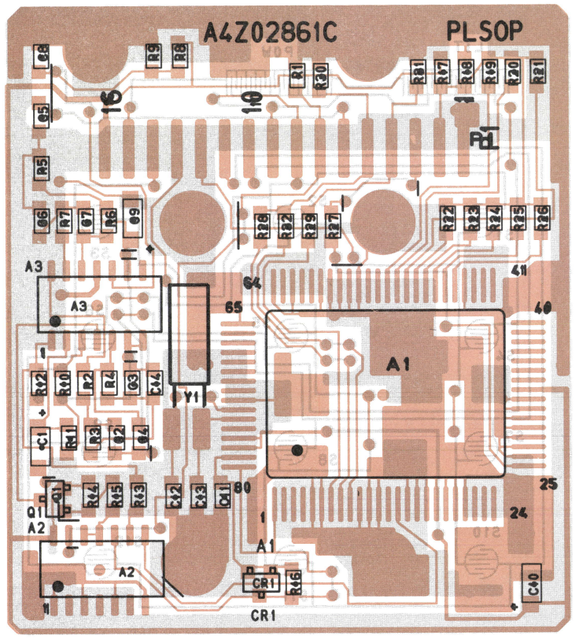



RUNS ON SOLDER SIDE
RUNS ON BOTH SIDES
RUNS ON COMPONENT SIDE

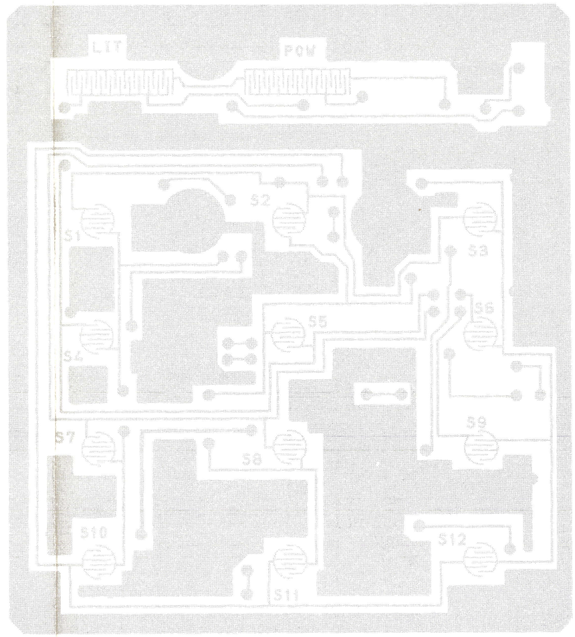



FLEXIBLE PRINTED WIRE BOARD
(A3Z02925A)

## COMPONENT SIDE

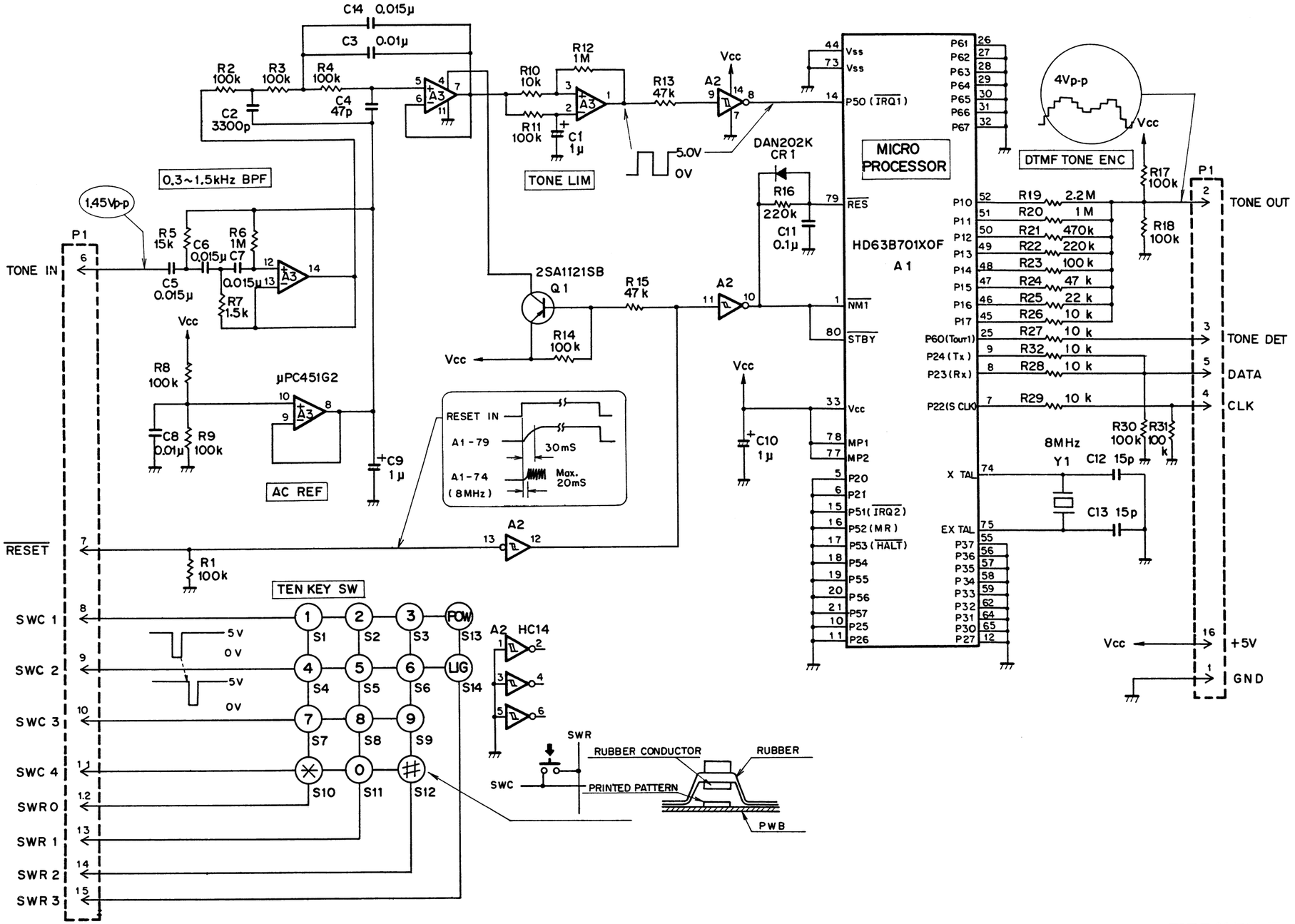



## SOLDER SIDE

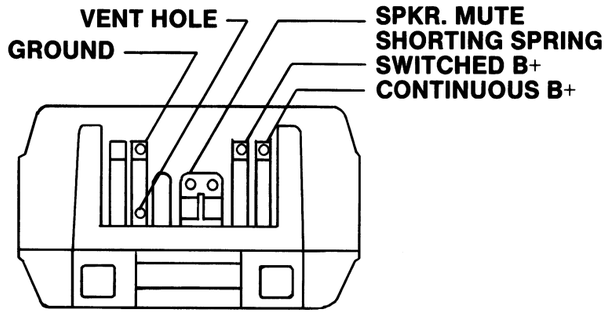



RUNS ON SOLDER SIDE
RUNS ON BOTH SIDES
RUNS ON COMPONENT SIDE

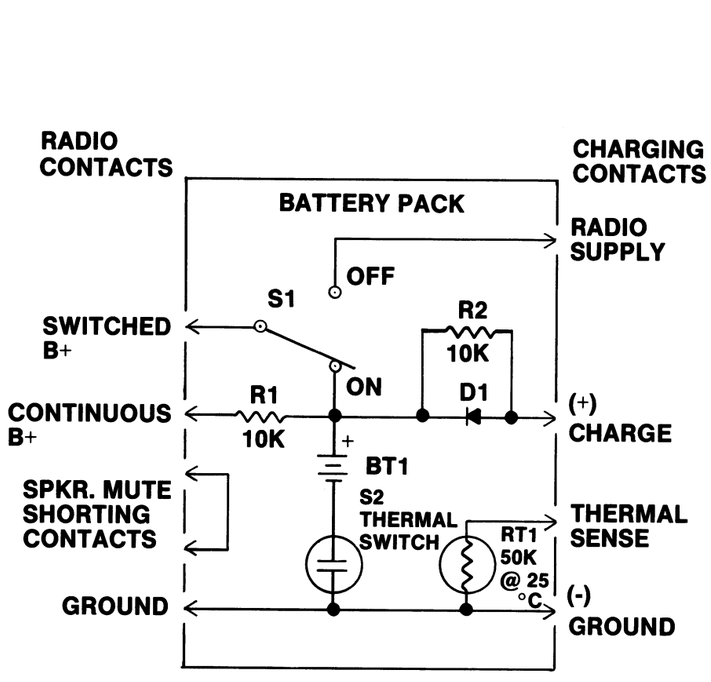
TYPE 99/DTMF
OPTION BOARDS
A4Z02861C




TYPE 99/DTMF
OPTION BOARDS
A4Z02861C

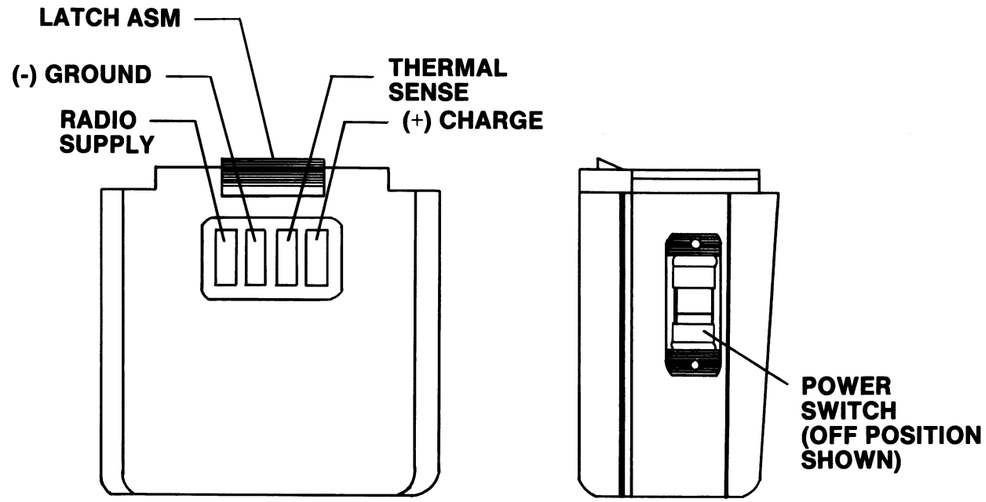



TOP VIEW




WIRING DIAGRAM

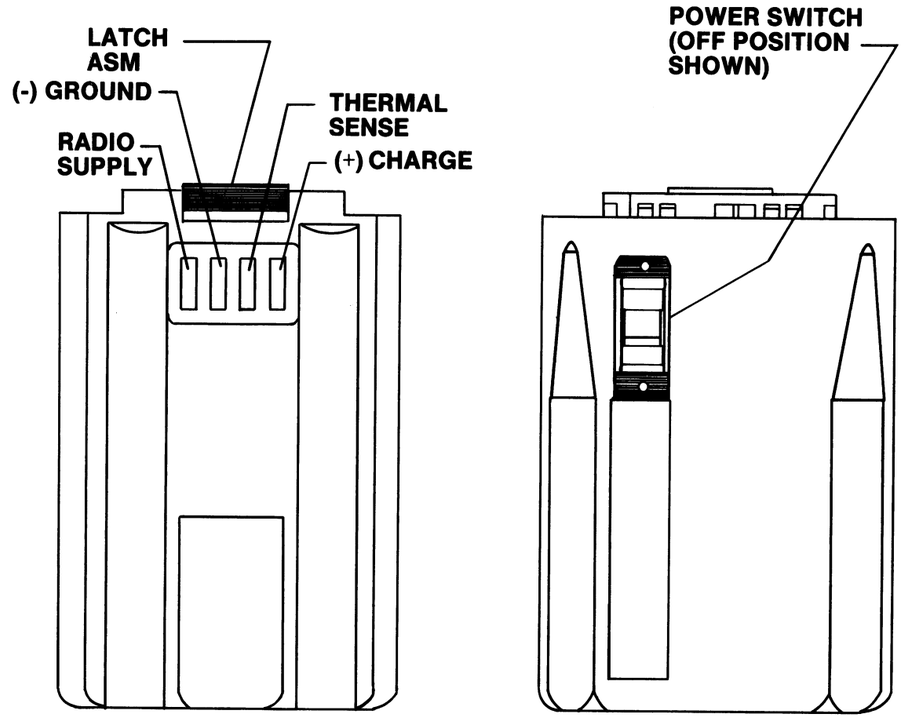
800 mAh AND 1200 mAh
BATTERY PACKS




REAR VIEW

SIDE VIEW

19A704850P1 & P3
(800 mAh)

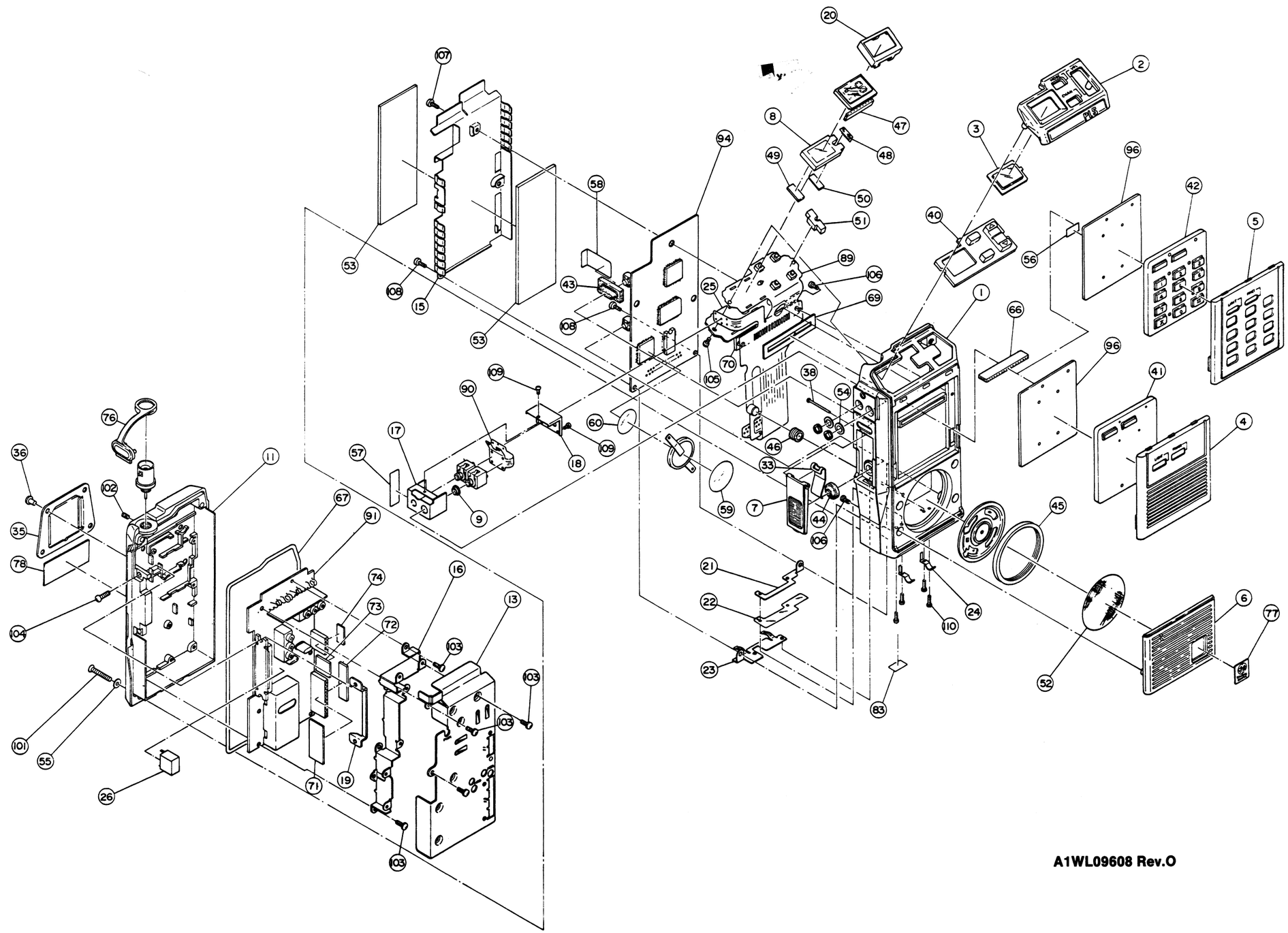



REAR VIEW

FRONT VIEW

19A704860P1 & P3
(1200 mAh)

RC-5493



A1WL09608 Rev.O

## PARTS LIST

LBI-31759

PLS UHF BAND
(MECHANICAL PARTS)

| SYMBOL | GE PART NO. | DESCRIPTION |
|---|---|---|
| 1 | K19/A1WL08209 | Frame. |
| 2 | K19/A2WL08165 | Top Cover. |
| 3 | K19/A4WL08170 | LCD Crystal. |
| 4 | K19/A2WL08167 | Non-Keyset Insert. |
| 5 | K19/A2WL08166 | Keyset Insert. |
| 6 | K19/A2WL08168 | Speaker Escutcheon. |
| 7 | K19/A3WL08169 | PTT Lever. |
| 8 | K19/A3WL08142 | Lighting Board. |
| 9 | K19/A4WL08406 | Spacer. |
| 10 | | NOT USED |
| 11 | K19/A1WL08177 | Cabinet Back. |
| 12 | | NOT USED |
| 13 | K19/A3WL09555 | RF Shield. |
| 14 | | NOT USED |
| 15 | K19/A3WL08626 | Logic Shield. |
| 16 | K19/A3WL09549 | Shield Plate. |
| 17 | K19/A4WL08404 | Jack Shield. |
| 18 | K19/A4WL08405 | Jack Shield Cover. |
| 19 | K19/A4WL08715 | Power Pack Bracket. |
| 20 | K19/A4WL08141 | LCD Frame. |
| 21 | K19/A3WL08215 | Positive Strap. |
| 22 | K19/A4WL08561 | Insulator Sheet. |
| 23 | K19/A3WL08214 | Negative Strap. |
| 24 | K19/A4WL08213 | Battery Connector Spring. |
| 25 | K19/A3WL08596 | Protector. |
| 26 | K19/A4WL09039 | DBM Case. |
| 27 | | NOT USED |
| 28 | | NOT USED |
| 29 | | NOT USED |
| 30 | | NOT USED |
| 31 | | NOT USED |
| 32 | | NOT USED |
| 33 | K19/A4WL09379 | PTT Spring. |
| 34 | | NOT USED |
| 35 | K19/A3WL07509 | Receptacle Plate. |
| 36 | K19/A4WL07694 | Rivet. |
| 37 | | NOT USED |
| 38 | K19/A4WL08175 | Pivot Pin. |
| 39 | | NOT USED |
| 40 | K19/A3WL08171 | Top Key Pad. |
| 41 | K19/A2WL08130 | Key Pad B. |
| 42 | K19/A2WL08129 | Key Pad A. |
| 43 | K19/A3WL08172 | Monitor Control Key. |
| 44 | K19/A4WL08173 | PTT Pad. |
| 45 | K19/A4WL08153 | Speaker Gasket. |
| 46 | K19/A4WL07594P1 | MIC Gasket. |
| 47 | K19/A4WL08144 | Inter Connector. |
| 48 | K19/A4WL08149 | Himelon. |
| 49 | K19/A4WL08146 | LCD Sponge A. |
| 50 | K19/A4WL08147 | LCD Sponge B. |
| 51 | K19/A4WL08888 | Top Sponge. |
| 52 | K19/A4WL08155 | Speaker Dust Screen. |
| 53 | K19/A4WL09161 | Sponge for Logic Shield. |
| 54 | K19/A4WL08205 | Washer. |
| 55 | K19/A4WL08928 | Washer. |
| 56 | K19/A4WL09189 | Tape for Crystal. |
| 57 | K19/A4WL09190 | Tape A. |
| 58 | K19/A4WL09191 | Tape B. |
| 59 | K19/A4WL09192 | Insulator for Battery. |
| 60 | K19/A4WL09193 | Battery Tape. |
| 61 | | NOT USED |
| 62 | | NOT USED |
| 63 | | NOT USED |
| 64 | | NOT USED |
| 65 | | NOT USED |
| 66 | K19/A4WL08154 | Inter Connector L. |
| 67 | K19/A4WL09303 | Housing Gasket. |
| 68 | | NOT USED |
| 69 | K19/A4WL08563 | Spacer. |
| 70 | K19/A4WL08595 | Plate. |
| 71 | K19/A4WL09185 | CN Spacer A. |
| 72 | K19/A4WL09186 | CN Spacer B. |
| 73 | K19/A4WL09187 | CN Spacer C. |
| 74 | K19/A4WL09188 | CN Spacer D. |
| 75 | | NOT USED |
| 76 | K19/A4WL09349 | Jack Cover. |
| 77 | K19/A4WL07721 | STD Nameplate (GE). |
| 78 | K19/A4WL08415 | FCC Label (U04). |
| 79 | | NOT USED |
| 80 | | NOT USED |
| 81 | | NOT USED |
| 82 | | NOT USED |
| 83 | K19/A4WL09603 | Serial Number Label. |
| 84 | | NOT USED |
| 85 | | NOT USED |
| 86 | | NOT USED |
| 87 | | NOT USED |
| 88 | | NOT USED |
| 89 | K19/A2WL08896 | Flexible P.W.B. |
| 90 | K19/A4WL08900 | Jack Flexible P.W.B. |
| 91 | K19/A3WL08408 | PLS UHF P.W.B. |
| 92 | | NOT USED |
| 93 | | NOT USED |
| 94 | K19/A3WL08741 | Logic P.W.B. (2 Layer) |
| 95 | | NOT USED |
| 96 | K19/A3WL08191 | Option P.W.B. |
| 97 | | NOT USED |
| 98 | | NOT USED |
| 99 | | NOT USED |
| 100 | | NOT USED |
| 101 | K19/A4WL08543 | Screw. |
| 102 | K19/3NAC026033 | Screw. |
| 103 | K19/3NAX001116 | Screw. |
| 104 | K19/3NAA009056 | Screw. |
| 105 | K19/3NAD049034 | Screw. |
| 106 | K19/3NAD049042 | Screw. |
| 107 | K19/3NAD049026 | Screw. |
| 108 | K19/3NAA405056 | Screw. |
| 109 | K19/3NAA502134 | Screw. |
| 110 | K19/3NAA502142 | Screw. |

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.

## PARTS LIST

PLS UHF PERSONEL RADIO
A4WE04058

ISSUE 1

| SYMBOL | GE PART NO. | DESCRIPTION |
|---|---|---|
| | | UHF Radio Board |
| | A4WE04030 | Control Board |
| | A4WE04031 | Flexible Board |
| | A4WE04032 | Key Board |
| | | - - - - - - - - - - CAPACITORS - - - - - - - - - |
| C1 and C2 | K19/2CAJ023094 | Ceramic, 1000 pF. |

## PARTS LIST

PLS UHF RADIO BOARD
A4Z02903C

ISSUE 1

| SYMBOL | GE PART NO. | DESCRIPTION |
|---|---|---|
| | | - - - - - - - - INTEGRATED CIRCUITS - - - - - - - |
| A101 | K19/2AAH025069 | uPB571C |
| A102 | K19/2AAH040027 | MB87001P |
| A104 | K19/2AAB004292 | UPB1251BG2 |
| A105 | K19/2YAA181772 | Crystal TCX-(1) A4WX01472 |
| A106 | K19/5UAD001115 | VCO A4WX01579 |
| A107 | K19/2AAE053015 | S-81250 TO-92 |
| A108 | K19/2AAE053015 | S-81250 TO-92 |
| A202 | K19/2AAA013138 | Hybrid IC A4WX01442-2M |
| A203 | K19/2AAA021646 | Hybrid IC KLH8514 |
| A301 | K19/2EDG002036 | DBM UST-2L-LO A4WX01451 |
| A302 | K19/2AAJ008089 | HA12442V |
| | | - - - - - - - - - - CAPACITORS - - - - - - - - - |
| C101 | K19/2CAK005909 | Ceramic chip: 100 pF ±5%, 50V. |
| C102 | K19/2CAK005818 | Ceramic chip: 22 pF ±5%, 50V. |
| C103 and C104 | K19/2CAK013119 | Ceramic chip: 0.01 uF ±10&, 50V. |
| C105 | K19/2CAK013127 | Ceramic chip: 1000 pF ±10%, 50V. |
| C106 | K19/2CAK013119 | Ceramic chip: 0.01 uF ±10%, 50V. |
| C107 | K19/2CAK005768 | Ceramic chip: 10 pF ±0.5 pF, 50V. |
| C108 | K19/2CBB033180 | Electrolytic: 220 uF, 10V. |
| C109 | K19/2CCF002072 | Tantalum: 1 uF, 16V. |
| C110 | K19/2CAK013119 | Ceramic chip: 0.01 uF ±10%, 50V. |
| C111 | K19/2CAK005768 | Ceramic chip: 10 pF ±0.5 pF, 50V. |
| C112 | K19/2CCF026173 | Tantalum: 1 uF, 35V. |
| C113 | K19/2CCC026157 | Tantalum: 0.1 uF, 35V. |
| C114 | K19/2CAK013119 | Ceramic chip: 0.01 uF ±10%, 50V. |
| C115 | K19/2CAK005685 | Ceramic chip: 2 pF ±0.25%, 50V. |
| C116 | K19/2CAK005693 | Ceramic chip: 3 pF ±0.25%, 50V. |
| C117 | | NOT USED |
| C118 and C119 | K19/2CAK013127 | Ceramic chip: 1000 pF ±10%, 50V. |
| C120 | K19/2CCF002072 | Tantalum: 1 uF, 16V. |
| C121 | K19/2CAK013119 | Ceramic chip: 0.01 uF ±10%, 50V. |
| C122 | K19/2CBB033180 | Electrolytic: 220 uF, 10V. |
| C123 | K19/2CAK005909 | Ceramic chip: 100 pF ±5%, 50V. |
| C124 | K19/2CCF002072 | Tantalum: 1 uF, 16V. |
| C125 and C126 | K19/2CAK013309 | Ceramic chip: 150 pF ±5%, 50V. |
| C127 | K19/2CGD013064 | Variable: TZB04N100BC |
| C128 | K19/2CAK005818 | Ceramic chip: 22 pF ±5%, 50V. |
| C129 | K19/2CAK013127 | Ceramic chip: 1000 pF ±10%, 50V. |
| C130 thru C132 | K19/2CCF002072 | Tantalum: 1 uF, 16V. |
| C133 | K19/2CAK013119 | Ceramic chip: 0.01 uF ±10%, 50V. |
| C134 | K19/2CAK013127 | Ceramic chip: 1000 pF ±10%, 50V. |
| C135 | K19/2CAK005909 | Ceramic chip: 100 pF ±5%, 50V. |
| C136 | K19/2CAK013119 | Ceramic chip: 0.01 uF ±10%, 50V. |
| C201 | K19/2CAK013127 | Ceramic chip: 1000 pF ±10%, 50V. |
| C202 | K19/2CAK005768 | Ceramic chip: 10 pF ±0.5 pF, 50V. |
| C203 and C204 | K19/2CAK013127 | Ceramic chip: 1000 pF ±10%, 50V. |
| C205 | K19/2CAK005693 | Ceramic chip: 3 pF ±0.25 pF, 50V. |
| C206 and C207 | K19/2CAK013127 | Ceramic chip: 1000 pF ±10%, 50V. |
| C208 | K19/2CAK005818 | Ceramic chip: 22 pF ±5%, 50V. |
| C209 thru C217 | K19/2CAK013127 | Ceramic chip: 1000 pF ±10%, 50V. |
| C218 | K19/2CAK005727 | Ceramic chip: 6 pF ±0.5 pF, 50V. |
| C219 | K19/2CAK005719 | Ceramic chip: 5 pF ±0.5 pF, 50V. |
| C220 | K19/2CAK013127 | Ceramic chip: 1000 pF ±10%, 50V. |
| C221 | K19/2CAK005701 | Ceramic chip: 4 pF ±0.25 pF, 50V. |
| C222 | K19/2CAK005669 | Ceramic chip: 1.5 pF ±0.25 pF, 50V. |
| C223 | K19/2CAK005701 | Ceramic chip: 4 pF ±0.25 pF, 50V. |
| C224 | K19/2CAK005693 | Ceramic chip: 3 pF ±0.25 pF, 50V. |
| C225 and C226 | K19/2CAK005743 | Ceramic chip: 8 pF ±0.5 pF, 50V. |
| C227 | K19/2CAK005685 | Ceramic chip: 2 pF ±0.25 pF, 50V. |
| C228 and C229 | K19/2CCC026264 | Tantalum: 10 uF, 16V. |
| C230 | K19/2CAK013119 | Ceramic chip: 0.01 uF ±10%, 50V. |
| C231 | K19/2CAK013127 | Ceramic chip: 1000 pF ±10%, 50V. |
| C232 | K19/2CAK013010 | Ceramic chip: 0.1 uF +80/-20%, 25V. |
| C233 | K19/2CAK013119 | Ceramic chip: 0.01 uF ±10%, 50V. |
| C234 | K19/2CAK031010 | Ceramic chip: 0.1 uF +80/-20%, 25V. |
| C235 | K19/2CCF002072 | Tantalum: 1 uF, 16V. |
| C240 thru C242 | K19/2CAK005909 | Ceramic chip: 100 pF ±5%, 50V. |
| C243 | K19/2CAK013010 | Ceramic chip: 0.1 uF +80/-20%, 25V. |
| C244 and C245 | K19/2CAK013119 | Ceramic chip: 0.01 uF ±10%, 50V. |
| C246 | K19/2CAK013010 | Ceramic chip: 0.1 uF +80/-20%, 25V. |
| C247 | K19/2CAK013127 | Ceramic chip: 1000 pF ±10%, 50V. |
| C248 | K19/2CAK013010 | Ceramic chip: 0.1 uF +80/-20%, 50V. |
| C249 | K19/2CAK013127 | Ceramic chip: 1000 pF ±10%, 50V. |
| C301 | K19/2CCF002072 | Tantalum: 1 uF, 16V. |
| C302 and C303 | K19/2CAK013127 | Ceramic chip: 1000 pF ±10%, 50V. |
| C304 | K19/2CAK005792 | Ceramic chip: 15 pF ±5%, 50V. |
| C305 | K19/2CAK013119 | Ceramic chip: 0.01 uF ±10%, 50V. |
| C306 | K19/2CAK005375 | Ceramic chip: 7 pF ±0.5 pF, 50V. |
| C307 | K19/2CAK005743 | Ceramic chip: 8 pF ±0.5 pF, 50V. |
| C308 | K19/2CAK005784 | Ceramic chip: 12 pF ±5%, 50V. |
| C309 | K19/2CAK005735 | Ceramic chip: 7 pF ±0.5 pF, 50V. |
| C310 | K19/2CCF002072 | Tantalum: 1 uF, 16V. |
| C311 | K19/2CAK005784 | Ceramic chip: 12 pF ±5%, 50V. |
| C312 | K19/2CCF002072 | Tantalum: 1 uF, 16V. |
| C313 | K19/2CAK005375 | Ceramic chip: 7 pF ±0.5 pF, 50V. |
| C314 | K19/2CAK013119 | Ceramic chip: 0.01 uF ±10%, 50V. |
| C315 and C316 | K19/2CAK013127 | Ceramic chip: 1000 pF ±10%, 50V. |
| C317 | K19/2CAK005669 | Ceramic chip: 1 pF ±0.25 pF, 50V. |
| C318 | K19/2CAK013127 | Ceramic chip: 1000 pF ±10%, 50V. |
| C319 | K19/2CAK013119 | Ceramic chip: 0.01 uF ±10%, 50V. |
| C320 | K19/2CAK005669 | Ceramic chip: 1 pF ±0.25 pF, 50V. |
| C321 | K19/2CAK005818 | Ceramic chip: 22 pF ±5%, 50V. |
| C322 | K19/2CAK013127 | Ceramic chip: 1000 pF ±10%, 50V. |
| C323 | K19/2CAK005867 | Ceramic chip: 47 pF ±5%, 50V. |
| C324 | K19/2CAK013119 | Ceramic chip: 0.01 uF ±10%, 50V. |
| C325 | K19/2CAK005792 | Ceramic chip: 15 pF ±5%, 50V. |
| C326 | K19/2CAK005842 | Ceramic chip: 33 pF ±5%, 50V. |
| C327 and C328 | K19/2CCF002072 | Tantalum: 1 uF, 16V. |
| C329 | K19/2CAK005743 | Ceramic chip: 8 pF ±0.5 pF, 50V. |
| C330 | K19/2CAK005925 | Ceramic chip: 330 pF ±10%, 50V. |
| C331 | K19/2CCF002072 | Tantalum: 1 uF, 16V. |
| C332 | K19/2CAK005768 | Ceramic chip: 10 pF ±0.5 pF, 50V. |
| C333 and C334 | K19/2CCF002072 | Tantalum: 1 uF, 16V. |
| | | - - - - - - - - - - DIODES - - - - - - - - - - |
| CR201 and CR202 | K19/2QBE004035 | MA57-TX |
| CR301 | K19/2QBE005016 | DAN202K T-96 |
| CR302 | K19/2QBE005024 | DAP202K T-96 |
| CR303 | K19/2QBA006166 | 1S2075K |
| | | - - - - - - - - - - FILTERS - - - - - - - - - - |
| FL301 and FL302 | K19/2FBD001620 | BPF 450-470 MHz A4WX01577 |
| FL303 and FL304 | K19/2FAA103082 | Crystal Filter A4WX01449 45 MHz |
| FL305 | K19/2FAD001572 | Ceramic Filter CFWMA455E |
| | | - - - - - - - - - - JACKS - - - - - - - - - - |
| J101 | K19/2PDA023044 | 69775-011 |
| J102 | K19/2PDA023036 | 69775-005 |
| | | - - - - - - - - - - COILS - - - - - - - - - - |
| L101 | | NOT USED |
| L102 | K19/2LAD001203 | Inductor NL322522T-018M |
| L201 | K19/2LAB013044 | Inductor 0.5 UEW ϕ 2 2T A4WX00027-2 |
| L202 | | NOT USED |
| L203 | K19/2LAB013127 | Inductor 0.5 UEW ϕ 2 10T A4WX00027-2 |
| L204 | K19/2LAB013051 | Inductor 0.5 UEW ϕ 2 3T A4WX00027-2 |
| L205 | K19/2LAD001161 | Inductor NL322522T-047M A4WX00027-2 |
| L206 | K19/2LAA001743 | Inductor LAL02KR R47M |
| L207 | K19/2LAB015106 | Coil 3 ϕ 2T A4WX01582 |
| L208 | K19/2LAB015098 | Coil 2 ϕ 2T |
| L209 | K19/2LAB015106 | Coil 3 ϕ 2T |
| L210 | K19/2LAB015098 | Coil 2 ϕ 2T |
| L211 | K19/2LAA001743 | Inductor LAL02KR R47M |
| L212 | K19/2LAB013044 | Inductor 0.5 UEW ϕ 2 2T A4WX00027-2 |
| L301 thru L303 | K19/2LAB013051 | Inductor 0.5 UEW ϕ 2 3T A4WX00027-2 |

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.

| SYMBOL | GE PART NO. | DESCRIPTION |
|---|---|---|
| L304 | K19/2LAB015072 | Coil A4WX01456 |
| L305 | K19/2LAD001229 | Inductor MLF321606A1ROM |
| L306 | K19/2LAB015072 | Coil A4WX01456 |
| L307 | K19/2LAD001229 | Inductor MLF321606A1ROM |
| L308 | K19/2LAD001260 | Inductor MLF322522T-R15M |
| L309 | K19/2LAD001302 | Inductor MLF322522T-027M |
| L310 | | NOT USED |
| L311 | K19/2LAD001195 | Inductor MLF322522T-039M |
| L312 | K19/2LAB015064 | Coil A4WX01457 |
| L313 | K19/2LAB015080 | Coil A4WX01458 |
| L314 | K19/2LAD001211 | Inductor MLF3216DR68K |
| | | - - - - - - - - - - TRANSISTORS - - - - - - - - - - |
| Q101 | | NOT USED |
| Q102 | K19/2QAD001026 | 2SA1121SBTL |
| Q103 | K19/2QAD001042 | 2SC2618SBTL |
| Q104 | K19/2QAD005076 | 2SD1781KT-96 |
| Q105 | | NOT USED |
| Q106 | | NOT USED |
| Q107 | K19/2QAD004020 | 2SC3356-T2B |
| Q108 | K19/2QAD005076 | 2SD1781KT-96 |
| Q109 | K19/2QAD005084 | 2SB1188-T101 |
| Q201 | K19/2QAD005076 | 2SD1781KT-96 |
| Q202 | K19/2QAD005084 | 2SB1188-T101 |
| Q203 | K19/2QAD005076 | 2SD1781KT-96 |
| Q204 | K19/2QAD004020 | 2SC3356-T2B |
| Q205 | K19/2QAD004038 | 2SC3357-T1B |
| Q206 | K19/2QAB015077 | 2SB1169 |
| Q301 thru Q304 | K19/2QAD004020 | 2SC3356-T2B |
| | | - - - - - - - - - - RESISTORS - - - - - - - - - - |
| R101 | | NOT USED |
| R102 | K19/2RGC001544 | Square chip: 220 ohms ±5%, 1/10W. |
| R103 and R104 | K19/2RGC001502 | Square chip: 10 ohms ±5%, 1/10W. |
| R105 | K19/2RGC001593 | Square chip: 2.2K ohms ±5%, 1/10W. |
| R106 and R107 | K19/2RGC001619 | Square chip: 4.7K ohms ±5%, 1/10W. |
| R108 | K19/ | Square chip: 0 ohms ±5%, 1/10W. |
| R109 | K19/2RGC001627 | Square chip: 10K ohms ±5%, 1/10W. |
| R110 | K19/2RGC001577 | Square chip: 680 ohms ±5%, 1/10W. |
| R111 | K19/2RGC001700 | Square chip: 1.5K ohms ±5%, 1/10W. |
| R112 | K19/2RGC001577 | Square chip: 680 ohms ±5%, 1/10W. |
| R113 | K19/2RGC001601 | Square chip: 3.3K ohms ±5%, 1/10W. |
| R114 | K19/2RGC001502 | Square chip: 10 ohms ±5%, 1/10W. |
| R115 | K19/2RGC001726 | Square chip: 47K ohms ±5%, 1/10W. |
| R116 | | NOT USED |
| R117 | | NOT USED |
| R118 | | NOT USED |
| R119 | K19/2RGC001528 | Square chip: 100 ohms ±5%, 1/10W. |
| R120 | K19/2RGC001551 | Square chip: 330 ohms ±5%, 1/10W. |
| R121 | K19/2RGC001585 | Square chip: 1K ohms ±5%, 1/10W. |
| R122 | K19/2RGC004126 | Square chip: 15K ohms ±5%, 1/10W. |

| SYMBOL | GE PART NO. | DESCRIPTION |
|---|---|---|
| R123 | K19/2RGC001627 | Square chip: 10K ohms ±5%, 1/10W. |
| R124 | K19/2RGC001585 | Square chip: 1K ohms ±5%, 1/10W. |
| R125 | K19/2RGC001726 | Square chip: 47K ohms ±5%, 1/10W. |
| R126 | K19/2RFB017063 | Variable: RGS6-FAN 10K ohms. |
| R127 | K19/2RGC001635 | Square chip: 22K ohms ±5%, 1/10W. |
| R128 | K19/2RGC001502 | Square chip: 10 ohms ±5%, 1/10W. |
| R129 | K19/2RGC001619 | Square chip: 4.7K ohms ±5%, 1/10W. |
| R130 | K19/2RGC001502 | Square chip: 10 ohms ±5%, 1/10W. |
| R131 | K19/2RGC001593 | Square chip: 2.2K ohms ±5%, 1/10W. |
| R201 | K19/2RGC001585 | Square chip: 1K ohms ±5%, 1/10W. |
| R202 | K19/2RGC001643 | Square chip: 100K ohms ±5%, 1/10W. |
| R203 and R204 | K19/2RGC001619 | Square chip: 4.7K ohms ±5%, 1/10W. |
| R205 and R206 | K19/2RGC001627 | Square chip: 10K ohms ±5%, 1/10W. |
| R207 | K19/2RGC001601 | Square chip: 3.3K ohms ±5%, 1/10W. |
| R208 | K19/2RGC001619 | Square chip: 4.7K ohms ±5%, 1/10W. |
| R209 | K19/2RGC001544 | Square chip: 220 ohms ±5%, 1/10W. |
| R210 | K19/2RGC001957 | Square chip: 22 ohms ±5%, 1/10W. |
| R211 | K19/2RGC001544 | Square chip: 220 ohms ±5%, 1/10W. |
| R212 | K19/2RGC001619 | Square chip: 4.7K ohms ±5%, 1/10W. |
| R213 | K19/2RGC001726 | Square chip: 47K ohms ±5%, 1/10W. |
| R214 | K19/2RGC001619 | Square chip: 4.7K ohms ±5%, 1/10W. |
| R215 | K19/2RGC001635 | Square chip: 22K ohms ±5%, 1/10W. |
| R216 | K19/2RFB017063 | Variable: RGS6-FAN 10K ohms. |
| R217 | K19/2RGC001569 | Square chip: 470 ohms ±5%, 1/10W. |
| R218 | K19/2RGC001700 | Square chip: 1.5K ohms ±5%, 1/10W. |
| R219 | K19/2RGC004266 | Square chip: 33 ohms ±5%, 1/10W. |
| R220 | K19/2RGC001551 | Square chip: 330 ohms ±5%, 1/10W. |
| R221 | K19/2RGC001585 | Square chip: 1K ohms ±5%, 1/10W. |
| R222 | K19/2RGC001957 | Square chip: 22 ohms ±5%, 1/10W. |
| R223 | K19/2RGC001502 | Square chip: 10 ohms ±5%, 1/10W. |
| R224 and R225 | K19/2RGC001569 | Square chip: 470 ohms ±5%, 1/10W. |
| R226 | K19/2RGC001627 | Square chip: 10K ohms ±5%, 1/10W. |
| R227 and R228 | K19/2RGC001551 | Square chip: 330 ohms ±5%, 1/10W. |
| R229 | K19/2RGC001585 | Square chip: 1K ohms ±5%, 1/10W. |
| R230 | K19/2RGC001809 | Square chip: 47 ohms ±5%, 1/10W. |
| R301 | K19/2RGC001544 | Square chip: 220 ohms ±5%, 1/10W. |
| R302 | K19/2RGC001825 | Square chip: 220K ohms ±5%, 1/10W. |
| R303 | K19/2RGC001577 | Square chip: 680 ohms ±5%, 1/10W. |
| R304 | K19/2RGC004449 | Square chip: 150K ohms ±5%, 1/10W. |
| R305 | K19/2RGC001718 | Square chip: 6.8K ohms ±5%, 1/10W. |
| R306 | K19/2RGC001536 | Square chip: 150 ohms ±5%, 1/10W. |
| R307 | K19/2RGC001585 | Square chip: 1K ohms ±5%, 1/10W. |
| R308 | K19/2RGC004449 | Square chip: 150K ohms ±5%, 1/10W. |
| R309 | K19/2RGC001650 | Square chip: 68 ohms ±5%, 1/10W. |
| R310 | K19/2RGC001718 | Square chip: 6.8K ohms ±5%, 1/10W. |
| R311 | K19/2RGC001551 | Square chip: 330 ohms ±5%, 1/10W. |
| R312 | K19/2RGC001544 | Square chip: 220 ohms ±5%, 1/10W. |
| R313 | K19/2RGC001700 | Square chip: 1.5K ohms ±5%, 1/10W. |
| R314 | K19/2RGC001635 | Square chip: 22K ohms ±5%, 1/10W. |

| SYMBOL | GE PART NO. | DESCRIPTION |
|---|---|---|
| R315 | K19/2RGC001817 | Square chip: 33K ohms ±5%, 1/10W. |
| R316 | K19/2RGC001627 | Square chip: 10K ohms ±5%, 1/10W. |
| | | - - - - - - - - - - THERMISTORS - - - - - - - - - - |
| TH301 | K19/2QBD016139 | NTCDS3018 3HG103HC |
| | | - - - - - - - - - - CRYSTALS - - - - - - - - - - |
| Y301 | K19/2YAA181723 | 44.545 MHz A4WX01448 |

## PARTS LIST

PLS CONTROL BOARD
A4WE04030

ISSUE 1

| SYMBOL | GE PART NO. | DESCRIPTION |
|---|---|---|
| | | - - - - - - - - - INTEGRATED CIRCUITS - - - - - - - - |
| A1 and A2 | K19/2AAE053023 | Voltage Regulator, S-81250HG-RD-T1 |
| A3 | K19/2AAE053049 | Voltage Detector, S-8054ALR-LN-T1 |
| A4 and A5 | K19/2AAB004284 | OP AMP, uPC451G2-T1 |
| A6 | K19/2ADA004404 | MICRO PROCESSOR, HD63705VOF |
| A7 | K19/2ACA017382 | S-RAM, TC5517AFL-2 |
| A8 | K19/2ADC003107 | LCD Driver, uPD7225G |
| A9 | K19/2AAJ016017 | Audio Processor, STC 9140F |
| A10 | K19/2AAJ010036 | Audio IC, NJM2073D |
| | | - - - - - - - - - LITHIUM BATTERY - - - - - - - - - |
| BT1 | K19/5PBA002052 | CR2032-T4 |
| | | - - - - - - - - - - CAPACITORS - - - - - - - - - |
| C1 | K19/2CAK013010 | Ceramic chip, 0.1 uF |
| C2 thru C5 | K19/2CCF002072 | Tantalum, 1 uF |
| C6 and C7 | K19/2CAK013010 | Ceramic chip, 0.1 uF |
| C8 | K19/2CCF002122 | Tantalum, 0.47 uF |
| C9 | K19/2CAK005917 | Ceramic chip, 220 pF |
| C10 and C11 | K19/2CAK013127 | Ceramic chip, 1000 pF |
| C12 | K19/2CAK013010 | Ceramic chip, 0.1 uF |
| C14 | K19/2CCF002072 | Tantalum, 1 uF |
| C15 | K19/2CAK005933 | Ceramic chip, 470 pF |
| C16 | K19/2CCF002072 | Tantalum, 1 uF |
| C17 | K19/2CAK005818 | Ceramic chip, 22 pF |
| C18 | K19/2CAK005685 | Ceramic chip, 2 pF |
| C19 | K19/2CAK005818 | Ceramic chip, 22 pF |
| C20 | K19/2CAK013119 | Ceramic chip, 0.01 uF |
| C21 and C22 | K19/2CCF002072 | Tantalum, 1 uF |
| C23 | K19/2CAK013119 | Ceramic chip, 0.01 uF |
| C24 | K19/2CAK005909 | Ceramic chip, 100 pF |
| C25 | K19/2CAK013010 | Ceramic chip, 0.1 uF |
| C26 | K19/2CAK013119 | Ceramic chip, 0.01 uF |
| C27 | K19/2CAK013135 | Ceramic chip, 0.015 uF |
| C28 | K19/2CAK013176 | Ceramic chip, 0.033 uF |
| C29 | K19/2CCF006024 | Tantalum, 6.8 uF |
| C30 thru C32 | K19/2CBJ001577 | Electrolytic, 68 uF |
| C33 | K19/2CAK013119 | Ceramic chip, 0.01 uF |
| C34 | K19/2CAK013143 | Ceramic chip, 3300 pF |
| C35 and C36 | K19/2CAK013010 | Ceramic chip, 0.1 uF |
| C37 | K19/2CCF002072 | Tantalum, 1 uF |
| C38 | K19/2CAK013010 | Ceramic chip, 0.1 uF |
| C39 | K19/2CBJ001577 | Electrolytic, 68 uF |
| C40 | K19/2CAK013010 | Ceramic chip, 0.1 uF |
| C41 | K19/2CAK005867 | Ceramic chip, 47 pF |
| C42 | K19/2CAK013010 | Ceramic chip, 0.1 uF |
| C45 thru C47 | K19/2CAK005933 | Ceramic chip, 470 pF |
| C49 | K19/2CAK005933 | Ceramic chip, 470 pF |
| C50 thru C55 | K19/2CAK013010 | Ceramic chip, 0.1 uF |
| C57 thru C65 | K19/2CAK013119 | Ceramic chip, 0.01 uF |
| C66 thru C72 | K19/2CAK005917 | Ceramic chip, 220 pF |
| C73 | K19/2CAK013010 | Ceramic chip, 0.1 uF |
| C74 | K19/2CAK005917 | Ceramic chip, 220 pF |
| C75 thru C77 | K19/2CAK005909 | Ceramic chip, 100 pF |
| C78 | K19/2CAK013127 | Ceramic chip, 1000 pF |
| C79 | K19/2CAK013010 | Ceramic chip, 0.1 uF |
| C80 | K19/2CAK005917 | Ceramic chip, 220 pF |
| C81 | K19/2CAK013119 | Ceramic chip, 0.01 uF |
| C82 | K19/2CAK013010 | Ceramic chip, 0.1 uF |
| C83 | K19/2CAK005917 | Ceramic chip, 220 pF |
| C84 | K19/2CAK013119 | Ceramic chip, 0.01 uF |
| C85 | K19/2CAK005917 | Ceramic chip, 220 pF |
| C86 | K19/2CCF002072 | Tantalum, 1 uF |
| C87 | K19/2CAK013119 | Ceramic chip, 0.01 uF |
| | | - - - - - - - - - - - DIODES - - - - - - - - - - |
| CR1 thru CR3 | K19/2QBE005016 | DAN202KT-96 |
| CR4 and CR5 | K19/2QBE005032 | DA204KT-96 |
| CR6 | K19/2QBE005016 | DAN202KT-96 |
| | | - - - - - - - - - - - FUSES - - - - - - - - - - - |
| F1 | K19/2DDB010183 | 251005 |
| | | - - - - - - - - - - - PLUGS - - - - - - - - - - - |
| P1 | K19/2PDA023101 | 65646-211 |
| P2 | K19/2PDA023093 | 65646-205 |
| P3 | K19/2PDA023192 | 68907-110 |
| | K19/2PDA023184 | 68907-105 |
| | | - - - - - - - - - - TRANSISTORS - - - - - - - - - |
| Q1 thru Q3 | K19/2QAD001034 | NPN, 2SC2462LCTL |
| Q4 | K19/2QAD001026 | PNP, 2SA1121SBTL |
| Q5 | K19/2QAD001034 | NPN, 2SC2462LCTL |
| Q6 | K19/2QAD001026 | PNP, 2SA1121SBTL |
| Q8 | K19/2QAD001026 | PNP, 2SA1121SBTL |
| Q9 | K19/2QAD001034 | NPN, 2SC2462LCTL |
| Q10 | K19/2QAD001026 | PNP, 2SA1121SBTL |
| Q11 and Q12 | K19/2QAD001034 | NPN, 2SC2462LCTL |
| | | - - - - - - - - - - RESISTORS - - - - - - - - - - |
| R1 thru R3 | K19/2RGC001585 | Square chip, 1/10W, 1K ohm ±5% |
| R4 and R5 | K19/2RGC001627 | Square chip, 1/10W, 10K ohm ±5% |
| R6 | K19/2RGC001585 | Square chip, 1/10W, 1K ohm ±5% |
| R7 | K19/2RGC001825 | Square chip, 1/10W, 220K ohm ±5% |
| R8 | K19/2RGC001627 | Square chip, 1/10W, 10K ohm ±5% |
| R9 | K19/2RGC001643 | Square chip, 1/10W, 100K ohm ±5% |
| R10 | K19/2RGC001627 | Square chip, 1/10W, 10K ohm ±5% |
| R11 | K19/2RGC001619 | Square chip, 1/10W, 4.7K ohm ±5% |
| R12 and R13 | K19/2RGC001627 | Square chip, 1/10W, 10K ohm ±5% |
| R14 thru R18 | K19/2RGC001643 | Square chip, 1/10W, 100K ohm ±5% |
| R19 thru R27 | K19/2RGC001627 | Square chip, 1/10W, 10K ohm ±5% |
| R28 thru R31 | K19/2RGC001643 | Square chip, 1/10W, 100K ohm ±5% |
| R32 | K19/2RGC001734 | Square chip, 1/10W, 180K ohm ±5% |
| R33 | K19/2RGC001528 | Square chip, 1/10W, 100 ohm ±5% |
| R34 thru R40 | K19/2RGC001627 | Square chip, 1/10W, 10K ohm ±5% |
| R41 and R42 | K19/2RGC001643 | Square chip, 1/10W, 100K ohm ±5% |
| R43 | K19/2RGC001528 | Square chip, 1/10W, 100 ohm ±5% |
| R44 | K19/2RGC001627 | Square chip, 1/10W, 10K ohm ±5% |
| R45 | K19/2RGC001791 | Square chip, 1/10W, 10M ohm ±5% |
| R46 thru R48 | K19/2RGC001643 | Square chip, 1/10W, 100K ohm ±5% |
| R49 | K19/2RGC004464 | Square chip, 1/10W, 43K ohm ±5% |
| R50 and R51 | K19/2RGC004381 | Square chip, 1/10W, 7.5K ohm ±5% |
| R52 | K19/2RGC001643 | Square chip, 1/10W, 100K ohm ±5% |
| R53 | K19/2RGC001759 | Square chip, 1/10W, 470K ohm ±5% |
| R54 | K19/2RGC001643 | Square chip, 1/10W, 100K ohm ±5% |
| R55 | K19/2RGC001759 | Square chip, 1/10W, 470K ohm ±5% |
| R56 | K19/2RGC001825 | Square chip, 1/10W, 220K ohm ±5% |
| R57 | K19/2RGC001817 | Square chip, 1/10W, 33K ohm ±5% |
| R58 | K19/2RGC001643 | Square chip, 1/10W, 100K ohm ±5% |
| R59 | K19/2RGC001726 | Square chip, 1/10W, 47K ohm ±5% |
| R60 and R61 | K19/2RGC001643 | Square chip, 1/10W, 100K ohm ±5% |
| R62 | K19/2RGC001841 | Square chip, 1/10W, 4.7 ohm ±5% |
| R63 and R64 | K19/2RGC001585 | Square chip, 1/10W, 1K ohm ±5% |
| R65 | K19/2RGC001643 | Square chip, 1/10W, 100K ohm ±5% |
| R66 | K19/2RGC001759 | Square chip, 1/10W, 470K ohm ±5% |
| R67 | K19/2RGC001726 | Square chip, 1/1-W, 47K ohm ±5% |
| R68 | K19/2RGC001817 | Square chip, 1/10W, 33K ohm ±5% |
| R69 | K19/2RGC001726 | Square chip, 1/10W, 47K ohm ±5% |
| R70 | K19/2RGC001817 | Square chip, 1/10W, 33K ohm ±5% |
| R71 | K19/2RGC001635 | Square chip, 1/10W, 22K ohm ±5% |

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.

| SYMBOL | GE PART NO. | DESCRIPTION |
|---|---|---|
| R72 | K19/2RGC001759 | Square chip, 1/10W, 470K ohm ±5% |
| R73 | K19/2RGC001643 | Square chip, 1/10W, 100K ohm ±5% |
| R74 | K19/2RGC001627 | Square chip, 1/10W, 10K ohm ±5% |
| R75 | K19/2RGC001585 | Square chip, 1/10W, 1K ohm ±5% |
| R76 | K19/2RGC001833 | Square chip, 1/10W, 2.2 ohm ±5% |
| R77 | K19/2RGC001593 | Square chip, 1/10W, 2.2K ohm ±5% |
| R78 | K19/2RGC001726 | Square chip, 1/10W, 47K ohm ±5% |
| R79 and R80 | K19/2RGC001627 | Square chip, 1/10W, 10K ohm ±5% |
| R81 and R82 | K19/2RGC001643 | Square chip, 1/10W, 100K ohm ±5% |
| R83 | K19/2RGC004449 | Square chip, 1/10W, 150K ohm ±5% |
| R84 | K19/2RGC001643 | Square chip, 1/10W, 100K ohm ±5% |
| R85 | K19/2RGC001759 | Square chip, 1/10W, 470K ohm ±5% |
| R86 | K19/2RGC001627 | Square chip, 1/10W, 10K ohm ±5% |
| R87 | K19/2RGC001593 | Square chip, 1/10W, 2.2K ohm ±5% |
| R88 | K19/2RGC001643 | Square chip, 1/10W, 100K ohm ±5% |
| R89 | K19/2RGC001726 | Square chip, 1/10W, 47K ohm ±5% |
| R90 | K19/2RGC001783 | Square chip, 1/10W, 3.3M ohm ±5% |
| R91 and R92 | K19/2RGC001627 | Square chip, 1/10W, 10K ohm ±5% |
| R93 and R94 | K19/2RGC001643 | Square chip, 1/10W, 100K ohm ±5% |
| R95 | K19/2RGC001726 | Square chip, 1/10W, 47K ohm ±5% |
| R96 | K19/2RGC001544 | Square chip, 1/10W, 220 ohm ±5% |
| R97 | K19/2RGC001627 | Square chip, 1/10W, 10K ohm ±5% |
| R98 | K19/2RGC001643 | Square chip, 1/10W, 100K ohm ±5% |
| R99 | K19/2RGC001593 | Square chip, 1/10W, 2.2K ohm ±5% |
| R100 | K19/2RGC001726 | Square chip, 1/10W, 47K ohm ±5% |
| R101 | K19/2RGC001833 | Square chip, 1/10W, 2.2 ohm ±5% |
| R102 | K19/2RGC001593 | Square chip, 1/10W, 2.2K ohm ±5% |
| R103 | K19/2RGC001627 | Square chip, 1/10W, 10K ohm ±5% |
| R104 | K19/2RGC001643 | Square chip, 1/10W, 100K ohm ±5% |
| R105 | K19/2RGC001825 | Square chip, 1/10W, 220K ohm ±5% |
| | | - - - - - - - - - - SWITCHES - - - - - - - - - - |
| S1 and S2 | K19/2KJA001042 | B3F-3120 |
| | | - - - - - - - - - - CRYSTALS - - - - - - - - - - |
| Y1 | K19/2YAA181665 | AT-41 3.579545 MHz A4WX01429 |
| | | - - - - - - - - - - MISCELLANEOUS - - - - - - - - - - |
| XY1 | K19/2YYZ001062 | NB-0252-0.5t |

## PARTS LIST

PLS FLEX BOARD
A4WE04031

ISSUE 1

| SYMBOL | GE PART NO. | DESCRIPTION |
|---|---|---|
| | | - - - - - - - - - - CAPACITORS - - - - - - - - - - |
| C1 thru C5 | | uDF4Y102 |
| | | - - - - - - - - - - - - LED - - - - - - - - - - - - |
| CR1 | K19/2HAA005343 | GL-1EG1 |
| | | - - - - - - - - - - - - JACKS - - - - - - - - - - - - |
| J1 and J2 | K19/2PFA001128 | S-G8512 |
| | | - - - - - - - - - - - - LCD DISPLAY - - - - - - - - - - |
| LCD | K19/2DCA005111 | T164009 |
| | | - - - - - - - - - - ELECTRIC MICROPHONE - - - - - - - - |
| MIC | K19/2SAA006109 | EM-78 |
| | | - - - - - - - - - - KEY BOARD SWITCH - - - - - - - - |
| S1 thru S4 | K19/2KJA018053 | JPM 1990-0101 |
| | | - - - - - - - - - - - - SPEAKER - - - - - - - - - - - - |
| SP1 | K19/2SDA005147 | T040S13 |

## PARTS LIST

PLS TYPE 99/DTMF BOARD
A4WE03822

ISSUE 1

| SYMBOL | GE PART NO. | DESCRIPTION |
|---|---|---|
| | | - - - - - - - - INTEGRATED CIRCUITS - - - - - - - |
| A1 | K19/2ADA004412 | Micro Processor, HD637B01X0F |
| A2 | K19/2ABD025020 | N-H-CMOS, uPD74HC14G-T1 |
| A3 | K19/2AAB004284 | OP AMP, uPC451G2-T1 |
| | | - - - - - - - - - - CAPACITORS - - - - - - - - - |
| C1 | K19/2CCF002072 | Tantalum, 1 uF |
| C2 | K19/2CAK013143 | Ceramic chip, 3300 pF |
| C3 | K19/2CAK013119 | Ceramic chip, 0.01 uF |
| C4 | K19/2CAK005867 | Ceramic chip, 47 pF |
| C5 thru C7 | K19/2CAK013135 | Ceramic chip, 0.015 uF |
| C8 | K19/2CAK013119 | Ceramic chip, 0.01 uF |
| C9 and C10 | K19/2CCF002072 | Tantalum, 1 uF |
| C11 | K19/2CAK013010 | Ceramic chip, 0.1 uF |
| C12 and C13 | K19/2CAK005792 | Ceramic chip, 15 pF |
| C14 | K19/2CAK013135 | Ceramic chip, 0.015 uF |
| | | - - - - - - - - - - - DIODES - - - - - - - - - - |
| CR1 | K19/2QBE005016 | DAN202KT-96 |
| | | - - - - - - - - - - TRANSISTORS - - - - - - - - - |
| Q1 | K19/2QAD001026 | PNP 2SA1121SBTL |
| | | - - - - - - - - - - RESISTORS - - - - - - - - - - |
| R1 thru R4 | K19/2RGC001643 | Square chip, 1/10W, 100K ohm ±5% |
| R5 | K19/2RGC004126 | Square chip, 1/10W, 15K ohm ±5% |
| R6 | K19/2RGC001775 | Square chip, 1/10W, 1M ohm ±5% |
| R7 | K19/2RGC001700 | Square chip, 1/10W, 1.5K ohm ±5% |
| R8 and R9 | K19/2RGC001643 | Square chip, 1/10W, 100K ohm ±5% |
| R10 | K19/2RGC001627 | Square chip, 1/10W, 10K ohm ±5% |
| R11 | K19/2RGC001643 | Square chip, 1/10W, 100K ohm ±5% |
| R12 | K19/2RGC001775 | Square chip, 1/10W, 1M ohm ±5% |
| R13 | K19/2RGC001726 | Square chip, 1/10W, 47K ohm ±5% |
| R14 | K19/2RGC001643 | Square chip, 1/10W, 100K ohm ±5% |
| R15 | K19/2RGC001726 | Square chip, 1/10W, 47K ohm ±5% |
| R16 | K19/2RGC001825 | Square chip, 1/10W, 220K ohm ±5% |
| R17 and R18 | K19/2RGC001643 | Square chip, 1/10W, 100K ohm ±5% |
| R19 | K19/2RGC003305 | Square chip, 1/10W, 2.2M ohm ±5% |
| R20 | K19/2RGC001775 | Square chip, 1/10W, 1M ohm ±5% |
| R21 | K19/2RGC001759 | Square chip, 1/10W, 470K ohm ±5% |
| R22 | K19/2RGC001825 | Square chip, 1/10W, 220K ohm ±5% |
| R23 | K19/2RGC001643 | Square chip, 1/10W, 100K ohm ±5% |
| R24 | K19/2RGC001726 | Square chip, 1/10W, 47K ohm ±5% |
| R25 | K19/2RGC001635 | Square chip, 1/10W, 22K ohm ±5% |
| R26 thru R29 | K19/2RGC001627 | Square chip, 1/10W, 10K ohm ±5% |
| R30 and R31 | K19/2RGC001643 | Square chip, 1/10W, 100K ohm ±5% |
| R32 | K19/2RGC001627 | Square chip, 1/10W, 10K ohm ±5% |
| | | - - - - - - - - - - CRYSTALS - - - - - - - - - - |
| Y1 | K19/2YAA181749 | SAT-310, 8 MHz, A4WX01728 |

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.

**ADDENDUM NO. 1 TO LBI-31742**
**(PC PL)**

This addendum adds to the UHF PLS Maintenance Manual (LBI-31742) the General Electric part number for the antenna used with the UHF PLS personal radio.

| | |
|---|---|
| **19A704723P25** | This is the antenna for PLS personal radio combination PLSU04, UHF Band, 450-470 MHz. This antenna is identified by a white colored ring around the BNC connector. |